# PHYSIOLOGICAL ESSAYS

## DRINK CRAVING,
## DIFFERENCES IN MEN, IDIOSYNCRASY,
## AND
## THE ORIGIN OF DISEASE.

BY

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# PHYSIOLOGICAL ESSAYS.

## DRINK CRAVING.

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MEN get drunk for various reasons, but the state of drunkenness, even when frequently repeated, does not necessarily constitute a man a drunkard in the sense in which I use the word. One man drinks to drown his sorrow, another is frequently led into drunkenness by his convivial qualities, a third drinks because he is weak-minded and is shamed into drinking by his stronger-minded companions, while a fourth drinks because the traditions of his trade demand that he should do so. If we can cure the sorrow of No. 1, if we can counteract the convivial tendencies of No. 2, and if we are able to rescue No. 3 from the dominion and society of his companions, and to protect No. 4 from trade influences, we shall most probably transform all the four without any difficulty into sober-living men—men who can abstain or indulge as their reason dictates. The middle and upper classes of England, as is set forth by Sir Walter Scott* and others, were in the last century very drunken in their habits; but the subsequent history of these classes has, I think, proved that they were drunkards rather in appearance than in reality,—that they drank more because it was the fashion in those days to drink than to gratify an imperious appetite. A true drunkard is he who cannot, or can only partially control his appetite for alcoholic stimulants, and who, according to the relative strengths of the craving and his voluntary control, does in various degrees, at the expense of purse, health, reputation, and all his duties, social and religious, indulge in alcoholic stimulants. At the one extreme stands the chronic drunkard—he who is continually drunk when he has the opportunity and the means of making himself so; and on the other, that admirable character who, although he has hitherto passed, and is still passing soberly through life, is nevertheless a drunkard, a latent drunkard—a man of strong mind and iron will, who knows that to drink a little is to let loose the caged devil within him,* and who is therefore a total abstainer.

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* See description of Osbaldistone Hall in 'Rob Roy.' Pepys in his Diary also throws much light on this question.

By the term "drink craving" I not only include the cases spoken of by some authors as of Oinomania, and by others as of Dipsomania, but also all cases where the craving for alcoholic stimulants is manifested in a degree which, if indulged, must be followed by disease.

Drunkards may be arranged in three classes—the periodic, the temporary, and the chronic. Dr. Hutcheson,* of Glasgow, uses the term acute instead of temporary, but I prefer the latter term, inasmuch as the characteristic feature of this class is the temporary (?) existence of the appetite, and the symptoms present in the other classes may be equally or even more acute than in this. Dr. Salvatori used the terms intermittent, remittent, and continued, to distinguish the different forms of the condition which he met with in Russia.†

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* Tavernier says that Shah Abbas II. was much addicted to wine, but did not on that account neglect State affairs. Sir John Chardin states much the same, and informs us that his successor, Solyman, loved wine and women to great excess, and being always half drunk, was exceedingly cruel in consequence. His son Hussein Abbas was so struck with the ill effects of wine, probably from his father's example, that he forbade the use of it in his dominions, until his mother feigned illness, and her physicians declared nothing but wine would save her life. Hussein instantly conceded the request out of filial piety, and obliged her so far as to taste it himself, on which he became as his two predecessors had been, a slave to a love of the juice of the grape, and the result was more fatal to Hussein than it had been to them. (Cyrus Redding on Wines, pp. 305, 306.)

The temporary form, as far as I know, always appears in connection with some disease of the body, and may be regarded as a symptom of these diseases. I have met with it in diarrhœa, sloughing phagedena of the cheek, and in an affection of the stomach simulating heart disease. Dr. Hutcheson‡ says it sometimes occurs in cases of heart disease, recoveries from fever, and puerperal hæmorrhage. Dr. Salvatori,§ it may be inferred from his paper on the subject, has met with it in cases of tapeworm; while it presented itself to Dr. Chevers‖ in two cases of affection of the head produced by exposure to the sun in India. The craving for stimulants in this form is sometimes manifested in the most intense degree.

In the periodic form the intervals between the attacks, and the duration of the attacks themselves, vary in different individuals, and at different times in the same individual. The attack may last only for one day, or it may endure over a week; and it may recur at any lapse of time between a week and a year. In time the attacks usually recur more frequently; and as in epilepsy the sparse paroxysms become daily paroxysms, so in periodic drink craving the fits of drinking in time run into each other, and constitute chronic drink craving. Further, as is the case in epilepsy, the approach of each fit of drinking, in this form of the condition, is usually announced by certain characteristic symptoms, by feelings of restlessness and inaptitude for work, of depression and general uneasiness, or it may be by some vague unsatisfied sensation which ultimately resolves itself into craving for stimulants, more or less irresistible. I have known it to occur in connection with the menstrual flow, and, in one marked case, to follow an attack of sunstroke in India. Dr. Hutcheson* has "observed it in individuals who have suffered from injuries of the head, in females during pregnancy, at the catamenial periods, and in the approach of the critical period and afterwards, and in men whose brains are overworked."

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* Report of the Glasgow Lunatic Asylum for 1842.

† Salvatori, "De Ebriositate Continua, Intermittente et Remittente," vol. ii. of the Transactions of the Physico-Medical Society of Moscow, translated in the 'Medical Critic and Psychological Journal,' No. 7, July, 1862. It was first noticed amongst English authors by Professor Christison, of Edinburgh. See his pamphlet 'On Some of the Medico-Legal Relations of the habit of Intemperance,' pp. 45, 46.

‡ *Op. cit.* § *Op. cit.*

‖ 'Medical Jurisprudence for India,' p. 558.

The continued form of drink craving is that with which we are most familiar. It is met with everywhere, and is as prevalent in Europe as fever is in India. Like the Great Plague, it walks about visible in our streets and public places, and is the presiding skeleton in very many houses. As is well known, when unchecked, its diagnostic symptom is daily drunkenness, less or more complete. When men are afflicted with this condition in its most virulent form, abandoning all other occupations, getting drunk becomes the business of their lives. The vision of alcohol fills their thoughts and imaginations at all times and in all places, and shuts them out as it were by an impassable barrier from everything around them that is respectable and human. All they think and do has reference to the indulgence of the overpowering appetite which has enslaved them. Afflicted in a less degree if, in the main, men attend to their daily business, and make a show of discharging their various duties, they probably at least select getting drunk to be their pastime. The most common cause of this form of drink craving is the habitual excessive use of alcoholic stimulants, that is, in quantities greater than is necessary to satisfy the natural wants of the body. The consequences of this excess are deterioration and disease of the tissues of the frame, and, *pari passu* with this deterioration, a weakening of self-control, and perversion of the moral faculties. The appetite grows stronger as its natural checks grow weaker, until in time, becoming despotic and all-powerful, it compels the enslaved mind and body of the man to leave all else and minister to its own indulgence. This form than any of the other forms of drink craving is more frequently inherited, and when it is so, it more rapidly acquires its maximum force. Dr. Hutcheson* observed it in cases of injuries of the head, heart disease, etc.; but I will treat of its causes more fully in the following chapter.

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* Report of the Glasgow Lunatic Asylum for 1842.

I may here briefly allude to the moral obliquity of the chronic drunkard, which is so generally remarked. Truthful and honourable in his sober days, he becomes a liar and a man without honour in his drunken. He makes many splendid promises, but rarely fulfils any of them. He is full of ambitious projects, and often sanguine of achieving renown. He relates much of what is untrue, but which, if true, would certainly redound to his credit, or would add in some way to his social position, or to the esteem in which he is held by others. He does so not because he confounds right with wrong, not because he has no sense of honour or truth, but mainly because his habits have rendered him weak and unfit to grapple with those external forces, moral and physical, against which we all have to contend for life and position. He feels himself insecure, and he endeavours to maintain himself with the assistance of flattery, self-praise, exaggerations, subterfuges of every description, and, if necessary, with downright falsehood, which have been the weapons of the weak in all times. This moral degradation is partly also, although in a minor degree, to be attributed to the habitual predominance of the animal appetites[*] other than that for stimulants which are excited by alcohol. The law by which these attain to permanent predominance will be alluded to when I speak of bad habits. Doubtless also the deterioration of the tissues plays its part in bringing about this result.

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* Report of the Glasgow Lunatic Asylum for 1842.

## *CAUSES.*

Causes[†] are usually spoken of under the heads, predisposing, exciting, and proximate, but in the case of drink craving at least it is very difficult to decide under which of these heads many causes should be arranged. For example, if a son inherit the appetite for alcohol from his father, shall we term the hereditary cause in him a predisposing, an exciting, or a proximate cause, or ought we not rather to regard the inherited condition as the disease itself? In consideration of this difficulty, I will speak of causes as remote and near only, according to my estimate of their force and value in producing the condition under consideration. Amongst the remote causes I will allude to occupation, mental constitution, hygiene, climate and race, and age. Amongst the near I will speak of hereditary transmission, certain diseased states of body, and of the habitual excessive use of alcohol; I wish it to be understood, however, that this arrangement is purely arbitrary, and does not preclude food or any other of the causes mentioned here from being regarded in this paper as in some respects as much a near as a remote cause. I may here remark that the causes classified as remote have more direct reference to the periodic and chronic forms of drink craving than to the temporary.

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[*] 'Macbeth,' act ii. scene 3.

[†] 'Inquiries concerning the Intellectual Powers and the Investigation of Truth.' By the late John Abercrombie, M.D. Oxon. and Edinburgh; 15th ed. p. 314.

## HYGIENE.

Defective hygienic arrangements I believe to be the fruitful cause of habitual excess in alcoholic stimulants, and through this of drink craving. Of two men similarly constituted, he who is well-fed, well-clothed, and well-lodged is certain—other things being equal—to be a more temperate man, as he will be a more healthy man, than his brother, who is subjected to all the opposite conditions. It has often been remarked, and the remark is daily being illustrated before the eyes of us all, that a slatternly wife makes a drunken husband. A badly-cooked dinner, a badly-washed shirt, the sight and smell of a filthy room, the disorder which reigns amongst the furniture, and the want of punctuality which usually characterizes the mistresses who rule such houses, detract, and most materially detract, from the husband's comfort, and what he cannot find at home he tries to find, or he seeks compensation for, in the spirit-shop.* Occasional exposure to physical discomfort acts as a stimulus to the functions of the body, and is not unwholesome; but continual† exposure ushers in these states of body which constitute the beginning of disease and very frequently lead to drink. As a remedy against these states men use alcohol, it appears to me, as naturally as, for much the same reasons, they use fire.* Drunkards abound in damp and badly-drained localities by the same law† that they abound in uncomfortable lodging-houses; and confinement in badly-ventilated, overcrowded rooms, it appears from evidence given before the Poor Law Commissioners in their first inquiry into the state of the labouring population, is a frequent cause of drink craving. It probably is so through the medium of the diseases which ensue upon prolonged exposure to the influences of those human exhalations which accumulate in overcrowded and insufficiently ventilated apartments. I will allude to this cause again under the head of occupation.

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* On this subject much interesting information can be obtained in Mr. Chadwick's first Report on the Labouring Population. See also Gairdner on 'Public Health,' pp. 268, 269, 270, and address of Lord Palmerston to the Romsey Agricultural Association, as quoted by Gairdner, p. 291.

† This may serve to explain why a nation in a barbarous state drinks harder than when it becomes civilized, and why the lower classes or civilized nations drink harder than the upper.

An insufficiency of food and food of an inferior quality both incite men to drink alcohol; these are not the least potent causes of drunkenness amongst hardworked and underpaid classes. Almost all underfed people drink alcohol greedily. In addition to this, it seems that certain kinds of food excite the alcoholic appetite, on the same principle as ham and chicken, and bacon and veal are eaten together, and as a man who eats much sugar rarely cares for spirits, and *vice versâ.* The great staple of the diet of the Scotch peasantry‡ is oatmeal, of the Irish, potatoes, of the Russian, rye bread, and of the Swedish,§ oatmeal and potatoes, and all of these peoples are immoderately fond of alcohol, and drink it copiously when they can obtain it. The connection is difficult of positive proof, but I cannot help concluding that the relation which exists between the consumption of alcohol and the consumption of farinaceous diets in these instances is, in some degree, rather of cause and effect than purely accidental. I say in some degree, for the drink craving may, and doubtless is, in part attributable to the dyspepsias* which afflict these peasantries, the consequence of too farinaceous a diet, and in part to the climate, peculiarities of soil, etc.

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* On this subject see remarks by Sir B. Brodie, 'Psychological Inquiries,' pt. i. pp. 77, 78, 79.

† This law is clearly illustrated in Howrah. In the best drained localities, where the houses are good, drunkenness is rarely met with, but it is common in the damp, jungly, badly-drained lanes, where the houses are one-storied and the floors damp.

‡ The Scotch hinds, who live chiefly on porridge and milk, are unusually fond of whisky, and many of them are not drunkards, only because they cannot procure the drink.

§ Huss's 'Om Suages Endimiska Sjukdomar,' Stockholm, 1852, and a review of this work in the 'British and Foreign' for October, 1852.

## CLIMATE AND RACE..

As differences in the social systems and religions which at present prevail on the globe are in some measure to be attributed to differences in climate, so, I think, are differences in the alcoholic appetite as manifested in the habits of different nations, European and otherwise. It is curious, and not a little instructive, to examine and compare the different substances employed by different nations to gratify their love of stimulants. Within and immediately without the tropics, opium, Indian hemp, tobacco, and betel-nuts are the substances most approved of by all except those in whom the appetite for stimulants is strongly developed, when, as is the case in other countries, all other substances (I speak generally) are abandoned for the abundant and reckless use of alcohol in some form.† Speaking of the northern hemisphere, as we journey towards the pole from the tropical regions‡ we discover that light wines, strong wines, and spirits, in the succession in which I name them, become the ruling stimulants of the countries through which we pass, until we arrive in the polar regions, where it is seen that alcoholic drinks are naturally abandoned* for butcher's meat, fats, and oils, which are eagerly sought after, even by foreigners, and ravenously consumed. Tea, coffee, and tobacco are stimulants which are relished in an equal degree almost all over the globe. With respect to Race, it is acknowledged by many historians and philosophers that this agency has had something to do in moulding the character of a nation, as developed in its manners and customs, and therefore it is not unwarrantable to conclude that the same cause affects a people in its relations to stimulants. It is, however, a matter of great difficulty, or I should rather say of impossibility, to trace how much the characteristics of a nation depend on race, mixed and unmixed, and how much on the struggle (extending over centuries) for existence and superiority with climate, the soil, and with other nations.

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* At some future date I hope to be able to illustrate the connection between tobacco, betel-nut, etc., and the farinaceous diet of the natives of Bengal.

† The consumption of spirits amongst the natives of Calcutta is very large. The produce of one rum distillery which turns out some 35,000 gallons a month is entirely absorbed by them, and this is only one of many streams which feed their demand.

‡ Mountains must be ranked with latitudes midway between polar and tropical regions. Thus, the inhabitants of the Alps indulge freely

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in spirits of some kind, so do the inhabitants of the hilly countries of Persia, Georgia, etc., and very recently M. Jules Gérard while hunting in the Himalayas, discovered that it was a point of etiquette that the inhabitants by villagefuls should get drunk on occasions. ('Voyages et Chasses dans l'Himalaya.')

* "The inhabitants of the Arctic regions appear to have a natural relish for the very oleaginous food which nature has provided for them in the whales, seals, bears, and other animals upon which they chiefly subsist; and this taste is acquired by Europeans when exposed to the same conditions.

Thus Dr. King, who accompanied Sir George Back in his overland expedition in search of Sir John Ross, informed the author that whereas he had been previously accustomed to reject every particle of fat, owing to the dislike he felt for it, he found himself able during his Arctic journey to eat any amount of it with relish, and even experienced a *positive craving* for it." (Carpenter's 'Physiology of Temperance and Total Abstinence,' 1853, p. 140.)

"Every soldier in the Russian service, it may be remarked, has an allowance of oil as part of his regular rations." (*Op. cit.*, p. 142.)

But it may broadly be affirmed that those nations of modern times which have manifested a continued impatience of despotism and a progressive affection for social and religious liberty are more given to strong drinks than nations of opposite tendencies. And therefore a national love of strong drinks, comparatively speaking, indicates national enterprise, constancy of purpose, liberality of thought, and aptitude for war, and a national hatred of moral littleness and of those soft and unnatural vices which prevail in warm latitudes. This statement requires to be received with some qualification, but in the main I believe it to be correct.

## OCCUPATION.

The subjoined statement is portion of a table compiled by Mr. Mayhew from the official returns of the Metropolitan Police, and published in his book entitled 'London Labour and London Poor.' According to Mr. Mayhew, these returns show that amongst

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| Button makers, | one individual | in every | 7·2 | is a drunkard. |
| Surveyors, | ,, | ,, | 11·8 | ,, |
| Millers, | ,, | ,, | 16·6 | ,, |
| Cutlers, | ,, | ,, | 18·2 | ,, |
| Musicians, | ,, | ,, | 22·0 | ,, |
| Bricklayers, | ,, | ,, | 22·6 | ,, |
| Labourers, | ,, | ,, | 22·8 | ,, |
| General and Marine Store Dealers, | | | 23·2 | ,, |
| Fishmongers, | ,, | ,, | 28·2 | ,, |
| Coachmen and Cabmen | | ,, | 28·7 | ,, |
| Sweeps, | ,, | ,, | 32·2 | ,, |
| Hairdressers, | ,, | ,, | 42·3 | ,, |
| Tailors, | ,, | ,, | 43·7 | ,, |
| Masons, | ,, | ,, | 49·6 | ,, |
| Printers, | ,, | ,, | 52·4 | ,, |

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|---|---|---|---|---|
| Sawyers, | one individual | in every | 58·4 | is a drunkard. |
| Butchers, | ,, | ,, | 63·7 | ,, |
| Medical Men, | ,, | ,, | 68·0 | ,, |
| Milliners, | ,, | ,, | 81·4 | ,, |
| Weavers, | ,, | ,, | 99·3 | ,, |
| Publicans, | ,, | ,, | 108·0 | ,, |

The peculiar circumstances under which some of these trades are followed go far to explain why the men who follow them should be more drunken than men who follow certain other trades. Millers stand high in the above scale of drunkenness, and this probably arises from their dusty occupation at home, and the custom which they practise of clinching their bargains with the aid of the bottle when abroad. Surveyors, again, in the proper transaction of their business meet with many thirsty people, and visit many public-houses in one day. They, as it were, continually travel within the influence of the temptation to drink; while musicians must of necessity in very many instances prosecute their calling in a sphere where liquor and every inducement to drink it abound. That coachmen and cabmen* should be more drunken than the average of the population of London can scarcely be a matter of surprise: they are indifferently paid, they are regularly exposed to all the changes and discomforts of the weather, and their daily round of duty is made up of alternate spells of business and idling on the stands. Moreover, they eat at irregular times, and their hours of work often extend over two-thirds of the day and night. Dr. Macnish† and, following him, Dr. Wilson‡ affirm that publicans are as a class intemperate, but this statement is scarcely in accordance with the Metropolitan Police Returns. It would also appear from the same returns that

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* Mayhew's 'London Labour and London Poor,' vol. iii. pp. 351, 352.

† 'Anatomy of Drunkenness,' p. 33; Glasgow, 1841.

‡ 'Pathology of Drunkenness,' p. 44.

Dr. Macnish has grievously maligned private servants in London, there being of this class only one in 585·9 a drunkard. This is temperance above the temperance of clergymen, and far above the average temperance of the country, which is very correctly represented by the temperance of medical men as stated in the above table. Mr. Mayhew's table makes it appear that button-makers of all tradesmen in London are the most addicted to alcoholic stimulants, but why a button-maker should be more intemperate than a cutler or a weaver I am at present unable to say; doubtless, however, a study of the circumstances under which these trades are followed would enable us to solve this problem. I am of opinion that the external conditions under which trades are pursued are more influential in leading this or that trade to be sober or intemperate than any agency which may be inherent in or inseparable from the prosecution of these trades. It is now a matter of fact that trades pursued under certain circumstances become sober; when pursued under certain other circumstances they have proved drunken.* The coal-whippers and coal-heavers of the London wharves are instances of this. These men were formerly under the dominion of the publicans, who had the patronage of the coal-trade in their hands, and who selected men as much because they were able to drink beer and gin as because they could carry coals. The introduction for a job was invariably, "You know, Mr. So-and-So, I am a good drinking man!" They were taught by the publicans and the older hands that no man could do his daily work without beer; that water would give them a pain in the stomach; that ginger-beer, and milk, and coffee, and tea might be better than water, but that they could not at all compete with beer, which put new sap into a man and oiled his joints. These doctrines became trade traditions, and were believed by almost every one in the trade, let him be whipper, backer, heaver, porter, or basket-man; and the consequence was that each spent from one to two-thirds of his weekly earnings in liquor which he procured at the public-house where he was paid. But the Legislature interfered, and, rescued by the law from the thraldom of the publican, and from the lessons of trade convictions by philanthropists like Mr. Mayhew, the coal-men are now a comparatively sober class.*

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* 'Psychological Inquiries,' by Brodie, pt. i. pp. 78, 79.

The following statement, made by Mr. Thomas Brownlow, journeyman tailor, before the Poor Law Commissioners in their first inquiry into the condition of the labouring population, shows how a trade may be drunken merely because it is followed in badly-ventilated and overcrowded rooms. He says, "The place in which we used to work at Messrs. A—'s was a room where eighty men worked together. It was a room about sixteen or eighteen yards long, and seven or eight yards wide, lighted with skylights; the men were close together, nearly knee to knee. In summer time the heat of the men and the heat of the irons made the room twenty or thirty degrees higher than the heat outside; the heat was most suffocating, especially after the candles were lit. I have known young men, tailors from the country, faint away in the shop from the excessive heat and closeness. . . .

"These work places are more unhealthy in winter, as the heat from the candles and the closeness is much greater. . . . Such has been the state of the atmosphere that, in the very coldest nights, large, thick tallow candles (quarter of a pound candles) have melted and fallen over from the heat. This state of things in the workshop had a very depressing effect on the energies. That was the general complaint of those who came into it. Many could not stay out the hours, and went away earlier. Those who were not accustomed to the places generally lost appetite. The natural effect of the depression was that we had recourse to drink as a stimulant. . . . I should say the greater part of the habit of drinking was produced by the state of the workplace; because, when men work by themselves, or only two or three together, in cooler and less close places, there is scarcely any drinking between times. Nearly all this drinking proceeds from the large shops, where the men are crowded together in close rooms; it is the same in the shops in the country as well as those in the town. In a rural place, the tailor, where he works by himself or with only two or three together, takes very little of the fermented liquor or spirits which the men feel themselves under a sort of necessity for doing in towns. The closer the ventilation of the place of work, the worse are the habits of the men working in them."

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* On this interesting subject see Mr. Mayhew's 'London Labour and London Poor,' vol. iii. p. 235 to p. 257.

Some months ago, when in London, I learned that sufficient accommodation for their men was now supplied by master tailors, and that a corresponding improvement in consequence had taken place in their habits as described by Mr. Brownlow. We may rest assured that when the men of one trade are very much more given to spirituous liquors than are the men of another trade, they are so mainly because they are worse paid and consequently worse housed, clothed, and fed, or because they are compelled to follow their avocations under conditions less favourable to health. Reliable statistics of the comparative amounts of drunkenness in different trades throughout the country still remain to be prepared. Before such statistics could be considered complete, it would be necessary to append to the mere lists of figures a statement in detail of the different external circumstances amongst which the different trades are pursued, circumstances sanatory and otherwise; but this I am afraid can never be accomplished unless under the direction of the Government.

The question being one of the greatest moment and intimately mixed up with the moral and physical well-being of the State, would far more than repay through public channels any public money expended on it. A Commission constituted like that which examined into the state of Lunacy in Scotland some years ago could, I believe, effectively carry out the investigation, not only in London, but in every town and parish in the country. It would be the especial duty of such a Commission to guard against cases of accidental drunkenness being included in the lists, and to see that no case of habitual drunkenness escaped detection. Pending the making of such an investigation, I will here enumerate certain classes of trades or occupations in the order, according to my belief, of their liability to suffer from the condition of drink craving.

1. Occupations followed in the midst of temptations to drink excessively; instance, innkeepers and publicans.

2. Occupations followed in badly ventilated localities, and requiring great muscular exertion; instance, coalwhippers.

3. Occupations followed in badly ventilated and overcrowded apartments, but requiring little muscular exertion; instance, London journeymen tailors as they used to be.

4. Outdoor occupations requiring little muscular exertion; instance, masons and bricklayers.

5. Indoor occupations of a sedentary nature; instance, clerks.

6. Indoor occupations of a non-sedentary nature; instance, shopkeepers.

7. Outdoor occupations in rural districts requiring great physical exertion; instance, farm labourers.

## AGE.

An old gentleman recently informed me that as a young man he was devoted to the bottle,—that then he freely indulged in alcoholic liquors, and often got drunk; but now as an old man, he had lost all taste for anything stronger than lemonade and ginger wine. The change, he added, was not of his own seeking,—it came with his advancing years and grey hairs, and brought him no pleasure, as his fondness for spirits had occasioned him no pain. In youth and middle age he was a very active man, full of energy and projects; moreover, his daily business required much anxious thought and physical exertion. "Often and often," he continued, "I have been thoroughly tired out and weary long before the day was half over, and this may have had something to do with my craving for strong drink." Since my conversation with this gentleman, I have turned my attention to this point. I have observed and conversed with those around me, I have recalled the careers of those of my contemporaries with whom I am acquainted, and I am now of opinion that, by a natural law, the appetite for stimulants increases with puberty, remains stronger through young and middle life, and declines in old age. Dr. Hutcheson's remark that drink craving sometimes appears at the critical period of a woman's life supports this statement.

## MENTAL CONSTITUTION.

All the qualities which lead men within the influence of the temptation to drink alcohol in excess in some form are doubtless indirect causes of drink craving. If a man be a good singer, a good actor, a good speaker, a successful retailer of jokes,—in a word, if he is possessed of the qualities which enable him to set the table in a roar,—or if he be an admirer of these qualities in others, then he will most probably be a member of dramatic and masonic clubs, a frequent guest at supper parties, and habitually present in those places where his convivial tastes and love of admiration can be gratified. But the gratification of these tastes is usually accompanied with the consumption of intoxicating liquors, and with the consequent production in some of the condition of drink craving.

It is commonly believed that many men take to drink because they are unhappy. If the unhappiness depend on physical discomfort,—for instance, on bad food, bad clothing, or bad lodging,—then the belief is well founded; but purely mental unhappiness, although a frequent cause of occasional —or I should rather say temporary—drunkenness, I believe to be a very rare cause of drink craving. Some men who have been afflicted with drink craving have also been afflicted with a congenital or hereditary melancholy, but in these cases both states were only the indications of bodily disease. Dr. Macnish* enumerates genius amongst the causes of the love of stimulants. I cannot from observation or reading support this assertion; I have met with drunkards possessed of ability in all the degrees which lie between the extremes of genius and idiocy in frequency, apparently in proportion to their comparative numbers. Addison, Sheridan, Byron, Poe, Burns, and Coleridge were all given to strong drinks, and one or two to intoxicating drugs, and it is the habit in connection with the fame and genius of such men that has given rise to the opinion expressed by Macnish. All of these men, with the exception of Addison, were possessed of ill-balanced minds, and their ability to shine in, and their love of, society, may have had quite as much to do with the production of drink craving in their cases as natural defects. Shakespeare, as far as we know, Milton, Francis Bacon, Walter Scott, and John Hunter, who may be acknowledged as ranking amongst England's very greatest men, were of temperate habits.

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* 'Anatomy of Drunkenness,' 1841, p. 35.

## *NEAR CAUSES.*

Habitual excessive use of alcohol, of all the causes of chronic drink craving is the most frequent and the most familiar. Its operation lies on the surface of our manners, and requires no illustration from me. In addition to creating or developing by degrees, usually slow, the state of irresistible drink craving, it engenders certain pathological conditions of the body which require to be here enumerated. All of these conditions are rarely present together in the body of a drunkard, and still more rarely are they altogether absent. Their nervous division constitutes the disease now recognized as chronic alcoholism, which in its causes, nature, and treatment has been fully treated of by Dr. Magnus Huss,* of Sweden, and following him by Dr. Marcet,† of the Westminster Hospital in London. These, as the appetite continues to be indulged, generally make their appearance in the order in which I now name them,—dyspepsia, broken and disturbed sleep, trembling of the hands, inability for mental labour less or more, probably an attack of delirium tremens, formications in the skin of the extremities (most frequently of the lower), weakness of the muscles below the knee, gradually deepening and extending until the lower extremities are paralysed partially or completely, degeneration of the nervous tissues, leading to epilepsy, mental debility, hallucinations, and imbecility. The last stage is almost sure to be reached, unless the patient is cut off by some other of the affections which habitual drunkards are liable to suffer from,—by adhesive inflammation or abscess of the liver, or by fatty degeneration of the liver, the kidneys, the heart, the blood vessels, or it may be of the general tissues of the body, which in course of time, it appears, not only become displaced by, but transformed into fat. It becomes an important question how far are these states the cause and how far the effect of drink craving and drunkenness. At present I can only say they increase together with the indulgence of the appetite, and decrease together with the non-indulgence of the same.

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* "Alcoholismus Chronicus," 'British and Foreign Medico-Chirurgical Review' for January, 1851, and April, 1852.

† 'On Chronic Alcoholic Intoxication, or Alcoholic Stimulants in connection with the Nervous System.'

## HEREDITARY TRANSMISSION.

Mr. G. Combe* says, " A friend told me that in his youth he lived in a country in which the gentlemen were much addicted to hard drinking, and that he frequently took a part in their revels. Several of his sons born at that time, although morally educated, became strongly addicted to inebriety; whereas the children born after he had removed to a large town and formed more correct habits were not the victims of this propensity." This and numberless other instances of the same kind, scattered through books and through the experience of all of us, prove what has scarcely ever been doubted,—that the appetite for alcoholic drinks can be transmitted by parents to their children. To such an extent is this the case, that the children of a drunken parent, or even the grandchildren of a drunken grandparent, require to be carefully watched and educated to prevent them from falling victims to the habit of drunkenness. A drunken father may not only beget a drunken son, but through him he may leaven whole families with the direful affection of drink craving, although nature has set limits to the spread of the evil, by in time sweeping away altogether those cases which she cannot cure. The following instance illustrates this law. A. D., a small landed proprietor, was given to violent exercise and strong drink. He was also fond of company and good living, and was by many regarded as the chief ornament of a convivial party. Subsequent to his marriage he became more intemperate than he had been before, and continued to practise his drunken habits until he died—a confirmed sot—of paralysis and kidney disease. He left six children behind him, three sons and three daughters, who in time all became drunken, but the eldest son less so than the others. The second son, while studying law in Edinburgh, fell into every kind of debauchery, and after pestering his friends and relations for some years with his poverty and his offensive habits, he took passage for America and died in an hospital in New York. The second son was brought up for the ministry, and gave much promise of eloquence and moral worth, until he also fell away into dissipated ways, and in spite of the moral checks which his office imposed upon his immoral appetites, drank the sacramental wine and went drunk into the pulpit. Expelled from the ministerial office, he lived a short life of drunkenness and beggary, and finally died in a workhouse. The eldest daughter tapped a barrel of rum in her husband's absence, and was by him discovered dead under it. The second daughter also died in the midst of a drunken paroxysm. The third daughter is still alive, and although not such a violent drunkard as her sisters were, she nevertheless gets drunk when the relaxed watchfulness of her husband permits her to do so. She is barren, as were also her dead sisters. The eldest son succeeded to his father's property, and married a clever woman. He drank more moderately than his brothers, still he was openly spoken of as intemperate. He died a violent death, leaving a family of two sons and three daughters. Of the sons the elder, after leading a short career of reckless dissipation, died unmarried; the younger is alive, but still unmarried. The eldest daughter had a delicate constitution, and died in childbed. The second suffers from scrofula. The youngest is married, but hitherto has proved barren. It will be observed that the only member of the first family blessed with progeny was the eldest son, who was begotten while his father was less intemperate than he afterwards became; but the existence of the family even in his line promises soon to be extinct. It is not too much to say that in this instance the ruinous calamities of two generations arose from the condition of drink craving in one man, and which was most probably viciously induced. Dr. Howe* alleges that of 300 idiots in the State of Massachusetts, whose history he investigated, the immense proportion of 145 were the offspring of intemperate parents. This indicates that the drivelling and staggering gait as well as the imbecility of the drunkard reappear in his children. As children in their features sometimes resemble their mothers and sometimes their fathers, so may they in their likes and dislikes for alcoholic drinks. Hereditary drink craving may disappear in one generation and reappear in the next. This irregularity may be explained in two ways; the children of the sober generation may resemble the sober parent, or the moral qualities which act as checks on the craving may exist in greater force in the children than in the drunken parent. But something also may be due to the operations of nature, which makes many and often successful efforts to rid herself of this as of other abnormal conditions. It not unfrequently happens that habitually temperate parents have one intemperate child. This may result from one or both of the parents being in a highly convivial humour, and temporarily disposed to indulge in alcoholic stimulants, when the child is begotten† and

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* 'The Constitution of Man, considered in relation to External Objects,' 9th edition, p. 150.

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* 'American Journal of Medical Sciences,' April, 1849, p. 437, and Carpenter's 'Physiology of Temperance and Total Abstinence,' page 41.

† The following passage given by Mr. G. Combe in his 'Constitution of Man,' 9th edition, page 325, bears on this point:—

" A gentleman who has paid much attention to the rearing of horses conceived. An example of this kind is given in the 'Phrenological Journal' (vol. vii. p. 47) and alluded to by Dr. Carpenter, when both parents were partially intoxicated at the time of the intercourse, and the offspring was completely idiotic. Or I believe it may result from the mother associating much with drunkards during the early months of her pregnancy. That impressions made on the minds of mothers affect the offspring "is an opinion of very ancient prevalence, and may be traced to so remote a period that its rise cannot be attributed to the speculations of philosophers." An historical instance of this is given by Sir Walter Scott and alluded to by Mr. Combe. "The father of Napoleon Buonaparte," says Sir Walter, "is stated to have possessed a very handsome person, a talent for eloquence, and a vivacity of intellect, which he transmitted to his son. It was in the middle of civil discord, fights, and skirmishes that Charles Buonaparte married Letitia Ramulini, one of the most beautiful young women of the island, and possessed of a great deal of firmness of character. She partook of the dangers of her husband during the years of civil war, and is said to have accompanied him on horseback on some military expeditions, or perhaps hasty flights, shortly before her being delivered of the future Emperor."* Mr. Combe attributes the natural

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informed me that the male race-horse, when excited, but not exhausted, by running, has been found by experience to be in the most favourable condition for transmitting swiftness and vivacity to his offspring.

"Another gentleman stated that he was himself present when the pale grey colour of a male horse was objected to; that the groom thereupon presented before the eyes of the male another female from the stable, of a very particular but pleasing variety of colours, asserting that the latter would determine the complexion of the offspring; and that in point of fact it did so. The experiment was tried in the case of a second female, and the result was so completely the same, that the two young horses, in point of colour, could scarcely be distinguished, although their spots were extremely uncommon."

* 'Life of Napoleon Buonaparte.'

timidity of James I. to the emotions of his mother on the occasion of the murder of Rizzio, she being pregnant with the young Prince at the time;* nor need the readers of history be at a loss for similar instances. The influence of impressions made on the mother during pregnancy is certainly greater than even popularly supposed, and I would therefore recommend all pregnant mothers not only to eschew all intemperance themselves, but also to avoid the society of drunkards.

## DISEASE OF THE BODY.

I have already enumerated the diseases in connection with which Dr. Hutcheson has observed the condition of drink craving. I have not met with this condition in all the diseases named by Dr. Hutcheson, although I have met with it in some, and also in some others not mentioned by him. These instances I will now proceed to give in detail.

### Case No. I.

Isabella Hay is the child of a healthy mother and a father who has suffered repeatedly from hæmoptysis. She is now 2½ years old. When about 10 months old, she began to suffer from indigestion and diarrhœa, which apparently arose from debility consequent on teething rather than from errors in diet. The disease proved unmanageable from the beginning. It was possible to check it through the administration of medicine, but not to eradicate it so far as to admit of the reappearance of appetite for usual food and of digestion. Food of any sort was neither tolerated by the bowels nor by the stomach. Its introduction almost immediately reinduced vomiting and purging. The mother predicted speedy death, and everything foreboded that the prediction would be realized. In the course of treatment port wine was prescribed, and from the very first borne by the gastro-intestinal canal and relished by the patient. The infant took it greedily, and very soon began to cry for it as in health she might have cried for the breast. I ordered the remedy to be given freely, and so strong was the patient's craving for the stuff, that she drank of it daily from 20 to 24 ounces. The rumour of this intemperance began to spread, and the child soon became the talk and marvel of the neighbourhood. Once, to satisfy her importunity for stimulants, her father substituted gin for port wine, and the relish for this immediately displaced the relish for the other. After this gin became her favourite drink. At this time her pertinacious appetite for alcohol, the ravenous manner in which she consumed it, the debility and peevishness of temper which characterized her before her cups, and the strength and good humour which characterized her after, constituted this infant a real drunkard. Alcohol was her chief sustenance and delight for several months. By-and-by she began to recover, and as her appetite for proper food and her strength began to return, her craving for strong drink began in equal proportion to decline, until the cold season and her thoroughly restored digestion enabled her finally to dispense with the aid of gin and water, and she is now fat, strong, and perfectly sober.*

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* 'Constitution of Man,' p. 148.

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* This is a case of such an extraordinary nature that I have thought proper to authenticate it by a letter from Mrs. Hay, which runs as follows :—

"HOWRAH, *January* 2, 1863.

"Sir,—In accordance with your request, I send you as truthful a statement of my little girl's case as I can remember. She was extremely ill for nine months; the first two months of that she had nothing but port wine and arrowroot; the four months following she lived solely on wine, brandy, and Hollands gin. Some days she drank one and a half bottles of port wine, and others not quite so much. She tired of that and then took to brandy, and, generally speaking, she used to drink one bottle a day; she also tired of that, then drank Hollands gin, and used to drink at least a pint a day. Food of any kind she would never taste

## CASE No. II.

A. G., æt. 5, like the above, was a resident of Howrah. She had been a delicate child from her birth, although she had never suffered from any serious illness. She was born in England, and on her mother rejoining her husband, who had come out to India in railway employ, accompanied her round the Cape. Her father was and is a healthy man, but her mother had for some years been threatened with phthisis. The patient herself was liable to attacks of bronchitis and swellings of the glands in the neck. I on several occasions examined her chest, but failed in detecting any permanently organic disease. The mesenteric glands were not enlarged; the urine occasionally was loaded with phosphates. Towards the close of 1860 she became climate-struck, and the diarrhœa of debility or indigestion, so very common in India, began insidiously to supervene. Medicine checked but did not cure the disease. In the course of treatment, as in the preceding case, port wine was prescribed, borne by the stomach, and relished by the patient; she took it ravenously from the first, and importunately demanded more. In a few days so greedy had she become of the stimulant, that to silence her the mother was fain to give her twice and three times the quantity ordered; in the night it was her custom to leave her bed, steal to the cupboard and help herself. At one time she consumed over twenty-four ounces a day. Fretful and irritable when sober, it was her custom when under the influence of the stimulant to sit up in bed and laugh and chat, contented and happy. Very

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**during that time. The next three months she got on gradually to take her food, and is now as fine and stout a little girl as you can see. I forgot to say previously she was only nine months old at the commencement of her illness.**

**" Yours respectfully,**
**" M. HAY.**

**" *To Dr. Bird.*"**

much emaciated, the wine was almost her sole support for several months. She died at sea on her way to England, reported to have fallen a victim to neglect.

### Case No. III.

Victoria Sterve, æt. 5, the child of East Indian parents, was brought to the Howrah General Hospital on the 15th of August, 1862, suffering from gangrene of portion of the right cheek. A circular spot of one inch in diameter in the centre of the cheek was dead, and in process of separation. The woman who brought her could give no very intelligible account of the beginning of the disease; the child, she said, had recently suffered from spleen, and a native doctor had attended her. The patient was lean, but not exceedingly emaciated; the expression of her face was that of past and present physical suffering, and care beyond her years. Her remarks and answers to questions put were precocious. Her pulse was compressible and very variable in frequency, running up and down easily between 100 and 140. Her appetite was good, curry being her favourite diet. The usual remedies were applied with various effect, and wine was prescribed among the number. As in the two preceding cases, the little patient relished this from the first, and when given to her devoured it as it were in ravenous haste; her allowance never satisfied her. When not asleep it was her custom to listen for the sound of my footsteps, that she might call me to her to ask for more; on these occasions she would take me by the hand and piteously beg me not to leave her till I had ordered her another measure. If her prayer was granted she would pat my hand and appear pleased, but if refused she would become unruly, and sometimes extremely angry. The disease proved intractable, diarrhœa supervened, and the gangrene spread so as to involve the whole right cheek.

The craving for wine increased with the disease, but owing to mechanical obstructions to swallowing, it was difficult to satisfy it. Towards the close of life the patient discarded wine and clamoured for brandy; the stimulant soothed and induced sleep without intoxicating. The appetite for food remained good to the last. The patient died on the 8th of September, 1862.

The above constitute a remarkable group of cases. They had many points in common; in all of them there was wasting of the tissues, nervous exhaustion, and impoverishment of the blood. Only one suffered from and fell a victim to gangrene; but the other two were in that state of body which strongly invites the attacks of this disease.

The following is a case of the periodic form of the condition running on into the chronic.

### CASE No. IV.*

M. M. married when she was thirty years of age. At the time of marriage she was active, lusty, and full of life. Blue-eyed, fair-skinned, and well-conditioned, she was handsome, without being beautiful; she ate well, slept well, and apparently keenly enjoyed the consciousness of existence. Her morals and temper were irreproachable. Her fair appearance and affectionate vivacity pleased all who knew her; still, even at this propitious time, unknown to most, she contained within her the seeds of that disastrous appetite, which least becomes a woman,—during her menstrual periods she was prone to alcoholic stimulants. In time she became pregnant and bore a child, and her craving for stimulants increased much during the term of lactation, and still more on the reappearance of the monthly flow. It declined during the second pregnancy, again to increase after the birth of the child, when becoming dominant and overpowering, its victim threw off all decency and secrecy in her attempts to gratify it. Her children were neglected, her household duties abandoned, and occasional drunkenness merged into daily drunkenness. Her husband, who was my informant, when he had guests at his table was in the habit of ordering her to keep her room on the plea of illness, but she only waited the departure of the guests to steal downstairs with the stealthy step of a cat and drain the decanters. Guests were banished from the house, and all liquor secured in the cellar; but the patient broke open the door with a hatchet; nor did removal of all alcoholic liquors from the house secure her from falling into the beastly state of drunkenness, for arraying her person in male attire, she procured from the neighbouring village what had now become the only object worth living for, and was found drunk on the roadside shortly afterwards. Restraint, amounting to imprisonment, was now the only means by which she could be kept sober. By-and-by the husband died, his widow removed from the neighbourhood, and I am unable to state what habits she now pursues.

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* This case was in Scotland.

This case tends to show that drink craving may originate in other conditions than that of nervous exhaustion or even deterioration of the blood. The patient was plump, strong, and active at the time when the appetite first manifested itself. It appeared in connection with the genital functions, and throughout, in some degree, maintained this connection; it is therefore in connection with these functions that we must elucidate the true pathology of the affection in this instance.

Dyspepsia has been mentioned by several authors as one of the causes of drink craving. Dyspepsia is a very vague term, and is conveniently used by many men to express those various states of body which constitute "seediness," or "general indisposition;" conditions which may harbinger attacks of fever, inflammation, or some other serious disease, and whose chief features are loss of appetite, reluctance to exertion, muscular or mental, and depression of spirits. When the affection is chronic it doubtless indicates some constitutional taint, hereditary or acquired, which may by external circumstances be developed in the form of consumption, madness, and drink craving, separate or combined. Charles Lamb, essayist and poet, in his letters to intimate friends frequently complains of his bad stomach, his bad spirits, and utter weariness of office. He sighs after change, for he thinks it may bring him relief, and in the meantime he seeks for comfort in his pipe and the gin bottle. Mr. Talfourd seems to think that his failing of intemperance in alcohol, found excuse and explanation in the misery which flowed to him from the insanity of his sister Mary, to whom he was so tenderly attached; it is more likely, however, that his failing and her insanity had one common hereditary origin. His brother John, not by any means deficient in natural feeling, did not fall into intemperate habits because of his sister's insanity; but he was strong, jovial, and burly.

The following case is an instance of dyspepsia simulating heart disease, which I believe to be a cause of drink craving in various degrees.

### CASE NO. V.

T. B., engaged in commercial business when twenty years old, began to complain of a sensation of tightness across the chest, and inability to draw a full inspiration. At one time on account of the same sensations, he sighed frequently, and bore on his countenance that expression of anxiety and suffering which the countenances of patients labouring under advanced heart-disease so often wear. During the attacks the action of his heart was rapid, and at times fluttering; this was especially the case at night, when the patient was forced to sit up in bed, overcome with the combined sensation of faintness and suffocation, and rouse his nervous system with draughts of cold water. During the intervals the action of the heart was normal, and its sounds healthy. When I saw him his tongue was thickly coated, his digestion very bad, and his bowels torpid; he had, he said, been losing flesh lately, and was miserably low-spirited. But the most curious of all the symptoms which attended this complaint, was the suddenly developed craving for alcohol, which afflicted him in proportion to the intensity of the disease, and which *pari passu* in every attack with the decline and disappearance of the disease, declined and disappeared. This young man is now upwards of thirty, and during the last ten years he has suffered from several relapses into the above affection, and from each he has obtained immediate relief and temporary recovery by means of change of air and mild aperient medicines. When well he is not only sober living, but has a positive dislike to alcohol. This form of dyspepsia is not uncommon in India, and in several instances I have seen it attended with a marked increase in the appetite for alcoholic stimulants. The following is an instance of another form of dyspepsia which is met with all over India.

## Case No. VI.

—— ——, a surgeon in H. M. Bengal Army, partly from mental anxiety, but mainly from irregular habits, such as frequent dining-out, eating hot tiffins, and hot suppers at billiard parties, etc., fell into general ill-health. He first suffered from indigestion and diarrhœa, which in him, as in many others, were the consequences of overeating and perhaps overdrinking. He began to sleep badly, and in the morning to complain of total loss of appetite and a tendency to retch; then every exercise began to seem a labour to him. He became irritable and low-spirited, and finally fell into that mental condition which Dr. Laycock* has named anæsthesia of the egotistical feelings, or general apathy, a condition which always depends on physical disorder. In close connection with the rise and progress of these states, the morbid appetite for alcohol appeared and progressed, until it fairly had dominion over him. From beer he got to brandy, and by-and-by the usual brandy-and-water of the midday was preceded by the usual brandy-and-water of the morning. Still regarded by the public as a sober man, he felt himself in secret to be a drunkard, and resolved to free himself if possible from the bondage before his shackles became riveted by further indulgence. He sought and obtained leave of absence to England, nor did he ever regret the step. He had to maintain a hard struggle against his clamorous appetite for stimulants as far as Alexandria, assisted as it was by the heat and the close atmosphere of an overcrowded ship; but the fresh waters and invigorating breezes of the Mediterranean enabled him to overcome his adversary, and before he reached Marseilles he was free. The following are his words in speaking of this happy release:—"My diarrhœa disappeared, my appetite for food returned, and after that cold water became almost my sole drink." Since the return of this gentleman to India he has suffered on two occasions from a slight relapse into the diseased states above described, both relapses in his opinion having been caused by dining out. Abstinence and a little Gregory's powder, however, have on both occasions at once removed the complaint and the fears attending it. This form of dyspepsia is especially common amongst European soldiers in India, induced in them by overeating, oversleeping, and the wear and rust of idleness. It is also amongst them a frequent cause of drink craving.

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* 'Mind and Brain,' vol. ii. p. 272.

It has been remarked by several authors that bodily and mental labour increase the appetite for stimulants. When the labour is immoderately prolonged, and the exhaustion is so great as to be attended with fever and loss of appetite for food this is certainly true, otherwise the appetite for food rather than the appetite for alcohol is excited. The senior wranglers and double firsts of the English universities are spoken of as great eaters rather than as great drinkers; and, as far as my experience carries me, I am of opinion that a healthy man when fatigued is satisfied with a very small amount of alcohol with his meals. I say a healthy man, for it cannot be disputed that labour increases the alcoholic appetite in persons whose health and digestion are constitutionally bad. Such a person was Mr. Pitt, who was in the habit of refreshing himself in the midst of his parliamentary labours with port wine in draughts of a bottle at a time.

## Case No. VII.

Has been from youth of a rambling disposition, and in the course of his wanderings has visited California, Australia, and China. He arrived in India about nine years ago, and was amongst the earliest employed on the East India Railway. Three years and a half ago, while following his occupation of a carpenter, he was struck down by the sun. Very shortly after recovering from this attack, he was seized with paralysis in one half of the body, and for this he was sent a sea voyage by his medical attendant; he returned almost well. Shortly after his return he began to manifest signs of intemperance in more ways than one; hitherto he had been sober and steady, and consequently his friends were not a little surprised when he now began to follow the habits of a drunkard and an eratomaniac. About this time also it was first observed that his mind was weaker than it hitherto had been. The habits above named by-and-by came to occupy so much of his time that he was almost always out of employ, and they proved so disgusting to his wife that she was forced to separate from him. In his better moments he would shed tears over his lamentable condition, and make promises of amendment, only to break them. In October last he was admitted into the Howrah General Hospital, suffering from onychia of the left great toe, and in the course of his residence there I satisfied myself that his mind was decidedly weak, that he was unnaturally insensible to pain, and that since he had suffered from disease of the toe he had suffered less from the craving for alcohol and sexual indulgence. His toe continues bad since his discharge, and it appears to me on that account he is proportionally temperate and steady.

The above is to me a very interesting case for three reasons: (1) because the diseased conditions on which the morbid appetites depend are located within the cranium; (2) because the two appetites had manifested themselves at the same time; and (3) because the power of both appetites has diminished since the supervention of disease in the toe. This latter fact serves to link this case with those in which direct connection is seen to exist between ulcers, on the one hand, and apoplectic symptoms and apoplexy, on the other. The affection has a physical origin, and is most probably within the influence of medicine.

## TAPE WORM.

Dr. Salvatori traced nine out of the fifty cases treated by him to tænia,* and it is to be presumed that these were all cured by the expulsion of the worm, otherwise he could scarcely have decided on the cause. I have at present a case of drink craving under my care,—a man,—who is suffering also from tapeworm; but not having succeeded as yet in expelling the whole of the parasite, I am still unable to decide how far the former affection depends on the latter.*

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* 'Medical Critic and Psychological Journal' for July 1862.

This completes my enumeration of the diseases in connection with which drink craving has hitherto been observed to manifest itself, but I venture to predict that when the minds of men have been fully and properly directed to the study, it will be found that this affection has its origin in, and depends for its existence on, pathological states of the body more varied and numerous than is believed or even suspected; and this leads me to a consideration of the nature of the condition.

## NATURE OF DRINK CRAVING.

Dr. Salvatori says,† "I therefore think that the proximate cause of drunkenness lies in the preternaturally exhausted state of the abdominal nerves, disturbed perhaps alike in fabric as in function.

"But besides this there seems to be another cause, which probably proceeds from the former, although it has less power in creating the disease, and which I think deserves not less attention; namely, from causes provoking and nourishing, predisposing and occasional, the humours also are depraved, the secretions of the abdominal viscera are impeded and perverted, so that not only do evil humours circulate through the entire body, but likewise, and chiefly, in the stomach, deposits noxious, irritating, and inimical to the nerves are formed. Therefore I think that to this, in addition to the depraved state of the nerves, chiefly abdominal, the whole disease is to be ascribed, and that against both of these causes every method of cure should be directed.'

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* The patient has since left the hospital and gone up country. I have not heard whether he has relapsed into intemperate habits.

† 'Medical Critic and Psychological Journal' for July, 1862.

From these and other paragraphs of his paper,—couched agreeably to the theories of the day,—it appears that, while Dr. Salvatori's idea of the nature of this affection was somewhat undefined, he had a firm conviction that the seat of the disorder was in the body, and not in the mind; and that the disorder itself was capable of cure. My readings and reasonings on this subject have carried me even further than this, for they have brought me to believe that drink craving is only the morbid development of an appetite for stimulants of some kind which *is natural and has been natural to all men in all ages.** This appetite might very conveniently and very appropriately be named the stimulant appetite. It is appeased with other substances than alcohol, —with opium, Indian hemp, betel-nut, tea, tobacco, and oil, as I have already hinted at; and as the appetite for food appreciates mutton, beef, ham, etc., more at one time than another, so in like manner this stimulant appetite at one time may prefer alcohol, at another tobacco, and so on. Its outward manifestation was as apparent in ancient times as it is in modern, and is intimately mixed up with the ancient and modern histories of all peoples. It has led and still leads people to the discovery and preparation of substances which can satisfy it, with the unerring certainty that another instinct has led men in all times and in all conditions of life to discover means of preparing fire; and these substances, when prepared, have been consumed by men as naturally as sugar is consumed by children. It is an appetite which gains size and force from its own indulgence, and depends for its full development on physical conditions engendered by habitual excessive use of intoxicating and stimulating substances, and on other causes as yet only partially known. Further, I believe that all men, if the most effective means be employed, can with more or less difficulty be made drunkards in various degrees, for that all have within them naturally the capability of becoming so. This is a doctrine which agrees with and explains all the facts connected with the craving which I myself have observed, or which I have read of as having been observed by others, and it is in harmony with the origin and growth of the affection of drink craving. In all these respects it closely resembles the over-indulgence of another appetite with which we have been endowed for perhaps more important ends,—I allude to the appetite for sexual intercourse,—and all that I have said of that appetite may with equal truth be said of this. The appetite for sexual intercourse, like the other faculties, is given to different men in different proportions, and like them is subject to the organic laws; it grows with use and lessens with disuse, it is inherited and transmitted. Moderately indulged, it is sanatorily and socially a blessing; immoderately, it becomes a curse to its victim and a social pest. Originally implanted in us for wise and beneficent ends, it has become in too many instances, through the excesses of ourselves and of our progenitors, an agent to fill our prisons and our hospitals. Nor are these appetites merely connected by the strict analogy which runs through their outward behaviour; they are intimately related, and, as it were, live next door. They are apt to operate together, and by their mutual action and incitement drive men to folly and debauchery. Salvatori* says this stimulant appetite morbidly developed, this *anamethysis*, this insane craving for alcohol, resides in the abdominal nerves. He is partially but not altogether right: we feel thirst in the throat, lust in the genitals, and hunger in the stomach, but we know that the seats of these appetites are elsewhere. So with this stimulant appetite, making itself felt in the stomach, it resides in the cranium amongst those other faculties which we have named propensities and instinct. It is thus that limited disease within the cranium may drive a man to be a drunkard, a libertine, a miser, etc., according to what portion of nerve matter is diseased.† It is thus, as in Case VII., that a man may suffer from drink craving and erotomania in connection with disorder of the intellect. It is thus that certain conditions of the blood excite in the brain through the intermediate nerves the appetite for food, for drink, or (as in Cases Nos. II. and III.) for alcohol. It is thus that some affections of the genital organs, which as yet are only imperfectly understood, may make a man a drunkard, an erotomaniac, or a maniac. And it is thus that a man may inherit the affection of drink craving, as he may that of abnormal vanity or abnormal ambition. According to the intensity of those morbid conditions on which drink craving depends, a man will, according to the nomenclature in use, be a drinker, a hard drinker, or an oinomaniac.

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* In propounding this doctrine I lay no claim to originality, although I arrived at the conviction by independent means; for I find that I have been anticipated by Sir B. Brodie, by Dr. Caldwell, of America, and perhaps by others whose writings I do not know. Sir B. Brodie says, "I admit that it seems to be something like an instinct which has led mankind in all ages to have recourse to them—alcohol, tobacco, Indian hemp, etc." (' Physiological Researches,' pt. ii. p. 93.) Mr. Combe writes, "In point of fact, Dr. Caldwell has shown much reason for considering the irresistible desire for intoxicating liquors as a symptom of cerebral disease, having its special seat probably in the organ of alimentariness." (' Constitution of Man,' 9th ed. p. 323.)

When drink craving has been induced by the habitual excessive use of alcohol, then it is usually spoken of by the profession and by the people as a vice or a bad habit. Dr. Guislain entitles it a vice of manners, by which I understand he means the carrying of what is right and proper to a vicious extent. Dr. Carpenter speaks of it in contradistinction to oinomania as a bad habit. Dr. Hutcheson says, referring to oinomania, "This form of mania is different from drunkenness, which, however, may lead to it.* The two first mentioned authors like the last, while they assert that drunkenness (by which they mean the expression of the appetite in a minor degree) is different from the dipsomania of some, the oinomania of Hutcheson, the anamethysis of Salvatori, and the drink craving of Christison,† they at the same time admit that the former may lead to the latter. But in reality they only give different names to the different stages of the same process: when the stimulant appetite is morbidly increased in the first degree they name its expression drunkenness; when the same is morbidly increased in the last degree they name it madness. Writers on inflammation act analogously.

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* 'Medical Critic and Psychological Journal' for July, 1862.

† For some lucid statements bearing on this matter, see 'Maladies Mentales,' by M. le Docteur B. A. Morel; Paris, 1860; pp. 259, 417, 418.

But it may not be out of place here to inquire, what is a bad habit. Does it, as Heinroth‡ seems to think it does, indicate some morbid change in the mind merely, in that subtle essence, of which when separated from the body we know so little; or does it show that some undue development has taken place in some part of the mind's material instrument§ which is incompatible with the mind's harmonious action? Is it in other words the placing at the command of one particular faculty a material agent so powerful as to enable it to override and subdue the other faculties? To believe the former doctrine would be to believe that the mind when separated from the body by death, carries with it, in the case of drunkenness, an appetite which has the strictest reference to matter; while to believe the latter is to believe what is uncontradicted by any fact, and what is supported by analogy. When we habituate ourselves to venereal excesses we become prone to practise lechery, just as, when we habituate ourselves to alcoholic excesses, we become prone to practise drunkenness. In the one case as in the other, frequent use has developed the material *i.e.* the nerve matter in which these appetites reside. The greater skill and strength of the right hand over the left is another illustration of the same law. To say then that a man has acquired a bad habit is equivalent to stating that his organization has become imperfect, viciously or otherwise as the case may be; and hence it is that bad habits are difficult to cure, but, from that tendency which the diseased body has to revert to its normal state, not incurable. Hence it is also that they can, like wounds and ulcers, be more readily cured in youth than in old age,—in youth when the body is plastic and pliant, than in old age, when it is rigid and unbending to all influences except decay. I know a man who again became a drunkard on returning amongst the scenes and associations where he had formerly practised the habit. I remember also the lively description which an officer before Sebastopol gave of his sensations on descrying a woman in the Russian lines, the first whom he had seen for many months. The stimulant appetite can, like the appetite for food, be excited through the memory acting on the imagination, and the sight of a sign-post may incite the drunkard to crave for alcohol, as the clatter of a knife and fork may incite the glutton to crave for food.

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* Report of the Glasgow Lunatic Asylum for 1842.

† 'Medico-Legal Relations of the habit of Intemperance.'

‡ See Prichard's 'Treatise on Insanity,' London, 1835, p. 8.

§ In connection with this question it is not only interesting but instructive to read the 'Timæus' of Plato. It is curious to note how far this celebrated man anticipated the Galls and Combes of modern times.

## THE TEMPERATE USE OF ALCOHOL.

Is alcohol poisonous in any quantity? This is a question on which men both in and out of the profession have long been divided. We all agree that the intemperate use of alcohol is destructive of health and fruitful of disease, but the question of the temperate use, it appears to me, has split us hopelessly into two sections. The champions of the one section, amongst whom are Dr. Carpenter* and Mr. Miller,† teach that, except in a very few cases of disease, the smallest quantity of alcoholic liquor acts perniciously on the system; while the champions of the other section, amongst whom are Dr. Lankester,‡ of London, and Dr. Inman,§ of Liverpool, say that a certain portion of alcohol is not only not injurious but that it is a wholesome and comforting addition to diet. Dr. Inman goes so far as to affirm that alcohol is not simply a stimulant, and that wine, beer, etc., satisfy the appetite when taken alone, and act for the time like any solid food would do. Further, he says he believes that nature has provided in the salivary glands, the liver, and the lungs of every mammal an apparatus for converting all food, especially farinaceous, into alcohol; but Dr. Inman adduces no experiment to prove the truth of this doctrine. Dr. Carpenter supports his position chiefly by Colonel Sykes' statistics of the Madras European Army, where it is shown that sickness and mortality prevail to a greater extent amongst the temperate soldiers than amongst those soldiers who totally abstain. But Colonel Sykes's tables are defective and may lead to wrong conclusions,|| inasmuch as they do not show

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* 'Physiology of Temperance.' † 'Alcohol, its Power and Place.'

‡ Popular Lectures on Food, delivered at the South Kensington Museum.

§ 'Lancet,' August 16, 1862.

|| Cases I., II., III., and VI. at least warrant me in making this objection.

how many of the temperate men were diseased when they began to drink, and how much the mortality is to be attributed to the habits of drunkenness, and how much to the diseases in which these habits originated. Neither do they set forth what means were taken to make it sure that no intemperate man was included amongst the temperate, nor what, in the opinion of the men who took the statistics, constituted temperance and what intemperance. One man has had a sun-stroke and gets drunk after one glass; another man can drink six glasses without his behaviour being affected by it; now to what class does the former belong, and to what the latter? Statistics, if not taken carefully, had much better not be taken at all. Dr. Carpenter* bases his opinion that alcohol in "moderate doses" is pernicious on other grounds; for he says, or he insinuates, which in a scientific work must be held to be the same as to say, that the disorders of persons advanced in life are those chronic morbid actions engendered by the moderate use of alcohol. What these disorders are he does not clearly define, but as far as I can see through the vagueness of his language he asserts them to be indigestion, plethora, nervous exhaustion, local congestions, and fatty degeneration of the various tissues of the body. But he admits that the connection between these diseases and alcohol, in the shape of cause and effect, cannot be demonstrated; and at the very beginning of his attempt to prove what cannot be demonstrated, he garbles a true analogy into a false to support himself. He compares the action of alcohol to the action of carbonic acid on the human frame, and he says, "Thus a man who would be rapidly suffocated by immersion in carbonic acid may live for weeks, months, or years, in an atmosphere slightly contaminated by it without experiencing any evil effects which he can slightly connect with its influence; and yet who will now deny that the constant action of this minute dose of aerial poison is insidiously undermining his vital powers, and preparing him to become the easy prey of any destructive epidemic ?" Can Dr. Carpenter be aware that the *pure* atmosphere of the globe contains carbonic acid ? Again, he continues, "The little I take does me no harm," is the common defence of those who are indisposed to abandon an agreeable habit, and who cannot plead a positive benefit derived from it ; but before such a statement can be justified the individual who makes it ought to be endowed with the gift of prophecy, and to be able to have present to his mind the whole future history of his bodily fabric, and to show that by reducing the amount of his excess to a measure which produces no immediate injurious results, he has not merely postponed its evil consequences to a remote period but has kept himself free from them altogether. The *onus probandi* lies with those who assume the absence of a connection which is indicated by every fact with which we are acquainted." Might not this passage with equal propriety have been written of potatoes, or cherries, or gooseberries ? and has not the author made some mistake when in one page he tells us the connection cannot be demonstrated, and in another he affirms that this *same* connection is indicated by every fact with which we are acquainted ? If a demonstration cannot be made through the indication of facts, how else is it to be made ? Then is it not contrary to English custom and the tendencies of the human mind to lay the *onus probandi* of the absence of this connection (*i.e.* between disease and moderate drinking) on the shoulders of the moderate drinker ? He calls upon me and every other moderate drinker to demonstrate what he himself cannot demonstrate. With equal justice might Dr. Carpenter scan the evils of tight lacing, and then call on me and all other loose dressers to abandon the agreeable habit of dressing until we could prove that it was not pernicious, although he might object that dressing is natural, but that there is in the constitution of man no instinctive or natural craving for stimulants. But while Dr. Carpenter could defend the theory of the instinctive use of clothing by appealing to the pages of history when he finds it written that our first parents clothed themselves in leaves, and that in all times it has been the custom of savages to array themselves in the skins of wild animals, and other ready-made coverings, I could also defend the theory of the instinctive use of stimulants by an appeal to the pages of written history. We are informed by the sacred Scripture that Noah planted a vineyard and afterwards got drunk. We see from what remains to us of their sculpture that the ancient Egyptians* also drank and got drunk. The legends of China relate that I-tye, a Chinese agriculturist, invented wine twenty-two hundred years before the birth of Christ.† Sir W. Jones writes "that Bala Rama was worshipped by the ancient Hindoos as the god of wine." That the ancient Greeks and Romans possessed and consumed a great variety of wines and strong drinks is abundantly proved by the writings of their poets, philosophers, and lawgivers. "The wines of a happier climate were the most grateful present, or the most valuable commodity that could be offered to the ancient Tartars; and the only example of their industry seems to have consisted in the art of extracting from mares' milk a fermented liquor which possessed a very strong power of intoxication."‡ The Eastern Huns lost their power over ancient China by permitting themselves to be surprised in their camp in the midst of sleep and *intemperance* by the Chinese generals.* When the Goths, impelled by the Scythian hordes, were struggling with the Greeks for a settlement in Thrace, we read that the watchful Fritiegern† (the General of the Goths) in the midst of *riotous intemperance* observed the motions and penetrated the designs of the Romans. "The ancient Germans‡ were in the habit of proceeding armed to convivial parties, in which it was no disgrace to pass days and nights without intermission in drinking." The vices of the Lombards were the effect of passion, of ignorance, of intoxication.§ Mahomedans, in spite of the unequivocal mandates of their prophet to the contrary, drink wine freely, in secret when not openly, in all the regions which lie between Constantinople and Calcutta.‖ The aboriginal inhabitants of North and South America, if they did not know how to extract wine from the wild grapes which abound on their continent, they at least were acquainted with the pleasure-yielding qualities of tobacco; and the first European colonists soon discovered that the taste and craving for alcohol had not to be created or even fostered amongst these peoples. Indeed the ready relish for alcohol at once displayed by these and others placed in similar circumstances when it was first offered to them is one of the surest proofs that the relish is natural and not acquired.** In fine, when I understand that in all times and places this appetite for stimulants has manifested itself among men and taught them the preparation and use of substances which satisfy it, I feel that I have no better reason to doubt its natural origin than I have to doubt the natural origin of that other instinct which in all times and places has taught men the preparation and use of fire.

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* 'Physiology of Temperance,' proposition iii. p. 78.

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* Wilkinson's 'Ancient Egyptians,' abridged edition, vol. i. pp. 52–3.

† Cyrus Redding's 'History and Description of Wines,' 3rd edition, p. 309.

‡ Gibbon's 'Rome,' Bohn's edition, vol. iii. p. 143.

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* Gibbon's 'Rome,' Bohn's edition, vol. iii. p. 156.

† *Op. cit.*, vol. iii. p. 177.

‡ Tacitus, Oxford translation, Bohn's edition, vol. ii. p. 313.

§ Gibbon's 'Rome,' Bohn's edition, vol. v. p. 124.

‖ See 'Travels of Marco Polo,' Bohn's edition, p. 51; also Cyrus Redding's 'History and Description of Modern Wines,' Bohn's edition, pp. 304, 305, 306, 307, 308.

** The Sandwich Islanders prepare an intoxicating drink by chewing and fermenting a certain root; so do the natives of New South Wales.

Dr. Carpenter and others have traced with minuteness and correctness enough the evil effects of the excessive use of alcohol on the stomach, the liver, the kidneys, the brain, the heart, the blood vessels, and the tissues generally; but, setting aside altogether the attempt to answer it, they have never asked themselves or their readers the question, "May not alcohol, taken in those doses which are not at least apparently hurtful, exercise some beneficial influence on the nutrition and functions of tissues in their ultimate structure?"

History and the conviction of the largest portion of mankind answer this question in the affirmative. The action of lime juice on the body in the cure and prevention of scurvy will enable Dr. Carpenter and others who profess his doctrines to understand how such an action may be possible, notwithstanding that alcohol "is not one of the proper components of the blood or of the tissues."* Dr. Carpenter has built his verdict on the theory of Liebig, that alcohol is burnt off in the furnace of the human body, in the shape of carbonic acid and water, in the maintenance of animal heat; while the experiments of Boocker, Prout, and Snow seem to show that the action of alcohol is to arrest the metamorphosis of the tissues, and to lessen the actual amount of carbonic acid given off in the twenty-four hours. If the conclusions of these latter gentlemen be correct, then the action of alcohol in cases of nervous exhaustion through disease, and in the wear and tear of common life, becomes intelligible. Without wholly agreeing or disagreeing with such a partisan writer as Mr. Miller on the one hand, or with Dr. Inman on the other, I may be permitted to recapitulate my own convictions on this matter.

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* Speaking of a simple transverse fracture of the thigh in a man of fifty, Mr. Fergusson writes:—"Nutritive food had no good effect, and I was at a loss what to do. Although assured by the patient that he had been temperate, from his looks there was reason to suspect the reverse, and he was ordered a reasonable quantity of whisky during the day. The change seemed marvellous! Within a week his countenance brightened up wonderfully from its previous sickly and languid aspect, swelling took place around the seat of fracture, and in little more than a month from the time that the use of the spirit was first commenced, a most excellent cure was accomplished."

1. That a perfectly healthy person* is less likely to suffer from the affection of drink craving than a person who is not perfectly healthy.

2. That the craving for alcohol and other stimulant substances is in very many instances only the expression of a natural and curative instinct.

3. That alcohol in a state of so-called health, if taken moderately, acts beneficially on the system. By a moderate quantity I mean so much as satisfies the natural appetite. It will differ in different individuals, and in the same individual at different times. In *perfect* health this quantity will be small.

4. That alcohol, if taken immoderately, *i.e.* in quantities more than sufficient to satisfy the natural appetite, does harm to all the tissues of the body, and has a tendency to induce the condition of drink craving."

## TREATMENT.

"Who does not observe that the habit of drunkenness may be cured by the mere art of the apothecary?" exclaims the enthusiastic Salvatori; and the exclamation contains the germ of a great social and sanatory reformation. I believe that the affection of drink craving, like the affection of meningitis, or of dysentery, having substance and shape, can be diagnosed, and in many instances cured. Dr. Salvatori has published a table wherein it is recorded that of 52 cases treated by him 28 were permanently and 14 temporarily cured. This is better success than other men have met with in the treatment of insanity, and encourages us to persevere in the course inaugurated by Dr. Salvatori. But I anticipate that even more successful results than this will reward us when, having divested our minds of the bonds of unquestioned custom, we apply them energetically to the cure and management of the affection.

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* A perfectly healthy person is rarely met with. One has a headache, another a toothache, a third complains of some uneasy sensation in his stomach, while a fourth is not quite well, he cannot tell why. A little reflection will convince us that the buoyant sensations of perfect health are occasionally, but very rarely, experienced by us.

We cannot now appeal to a long record of undoubted cures, only because we have not attempted to make the cures. Had the doctrines of the distinguished Russian physician whose name I have mentioned been acted on since the day when they were proclaimed in Moscow, in the beginning of the present century, then I venture to say that the condition of drink craving had been in these days as subject to the science and art of medicine as are these various other conditions which constitute lunacy. But we have continued to regard it as a vice when we should have looked upon it as a disease, in most instances viciously induced, and this has shut up our understandings in this direction, and turned away the currents of their inquiry into other channels, and so we have left our work to be done by others,—by philanthropists and clergymen, nobly, still imperfectly; and bands and stripes have been prescribed by the administrators of the broken law instead of wholesome restraint in a suitable sanatorium and medicine. Science, however, has advanced and is advancing, new ideas begin to permeate the public mind, and as great a revolution in the management of drunkards promises to mark the close of the present century as the change in the management of lunatics marked its beginning.

If chronic alcoholism, the main symptoms of which I have given in a previous page, be present, then we must preface the treatment of the craving by the treatment of this, but for full instructions in this matter I must refer the reader to the works of Magnus Huss and Marcet already named. In the cure of alcoholismus chronicus Huss trusts mainly to fusel-oil (hydrated oxide of amyle) in minim doses, but does not dispense with the assistance of opium, of camphor, of arnica, nor yet of stimulants fixed and diffusible: while Marcet* believes that he has discovered in oxide of zinc a remedy "possessed of powerful and definite medicinal properties, and having the remarkable property of restoring to health, or, at all events, of greatly relieving the disordered nervous system of persons suffering from chronic alcoholism." Guided by my own experience, which however is limited as yet, I am inclined to think that Marcet has overrated the virtues of this drug.

The craving itself must be treated according to its cause and the form in which it makes its appearance. If it be of the temporary form, the disease in the course of which it makes its appearance will necessarily influence us in the selection of remedies. If the disease be diarrhœa, or sloughing phagedena, or dyspepsia, the cure of the craving will most surely be secured by the cure of these diseases. In India, where many—nay, most (?)—of the cases are of the temporary form, it will be found when the affection begins to be treated that change of air to Europe, as in Case No. VI., will prove the most certain remedy which can be employed. Of all forms of the condition the temporary is the most hopeful and the most curable. The periodic form is very much more difficult to deal with; its pathology is more obscure, and when understood less easily cured. If it depends on hereditary causes, then, like inherited conditions of every description, it may be controlled and directed, but scarcely eradicated. In one instance, when the paroxysms followed an injury to the head, and were preceded or attended by symptoms of cerebral disturbance, such as headache, irritability of temper, moroseness, and an indescribable unsatisfied feeling, I found the attack could be mitigated or altogether avoided by means of a brisk purgative, a sinapism to the nape of the neck, and a full opiate when the bowels had been freely moved. I may here remark that I have been on several occasions struck with the remarkable resemblance which the premonitory symptoms of certain cases of epilepsy bear to the premonitory symptoms of certain cases of periodic drink craving, and I venture to predict that the pathology of these affections, when better understood, will be discovered to be more closely allied than at present can be proved. When the complaint makes its appearance in females in connection with some disease or irregularity in the functions of the womb or ovaries, then its cure is most likely to be found in the application of the remedies prescribed for such diseases and irregularities by writers who have made them their study. It was in a case of periodic drink craving apparently connected with an irregularity in the menstrual flow that Dr. Salvatori first used the *Thymus Serpyllum* which afterwards in his hands proved so efficacious. He says, "I remembered the recommendation by the immortal Linnæus of Serpyllum, which has been recorded both verbally and in writing by Murray, the distinguished pupil of that illustrious man, as an antidote to headache arising from excess; I therefore prescribed a draught of Serpyllum Saffron and Cardamoms. She passed a quiet night. On the following day, the 23rd, she was much better, and appetite for food with sleep gradually returned. On the 24th she blushed when she saw me. . . .

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* 'Chronic Alcoholic Intoxication,' p. 77.

The patient herself subsequently, anticipating by her own instinct the perception of the physician, for fear of a returning paroxysm at every new period sought for the remedy, and, undeceived by her hopes, patiently took it for six months during the periods of menstruation, which formerly were also those of drunkenness." This physician, in the paper cited, gives the details of other cures and a table of 52 cases, of which, as I have already said, 28 were permanently cured. "By this," he continues, "the efficacy of the remedies which I administered is more than established." He used this drug in all forms of the affection, and apparently with equally happy results. Dr. Christison remarks of the remedy, "I could not imagine such potency in the only Serpyllum of my acquaintance, the pretty little purple-flowered wild thyme which abundantly clothes Arthur's Seat . . . but such it is." When in London some months ago, I requested Messrs. Hodgkinson, Tonge, and Stead, of Upper Thames Street, to prepare me a quantity of the fluid extract of the plant, and since my return to Howrah I have used it in the treatment of those states of body which usually follow a prolonged debauch, but as yet have had no favourable opportunity of trying its qualities in the cure of the condition in which the craving originated. The cases treated were resident in the Howrah General Hospital, and during the application of the remedy they were carefully watched. The drug was prescribed in drachm doses every four hours, and it appeared to me to have a sudorific effect, to soothe and to induce sleep. In two cases especially, when the symptoms on admission presaged the speedy supervention of delirium tremens, the effect of the medicine in reassuring the nervous system and in this way inducing sleep could scarcely be doubted. Hitherto my attempts by means of it to reduce within natural limits the appetite for alcohol have been baffled by the obstinacy, the irregularities, and the relapses of the patients who were the subjects of the experiments, but from the little experience which I have had I incline to believe with Dr. Christison that Salvatori has overrated the virtues of the drug. Nevertheless, I consider that the undoubted power which it exercises over the nervous system entitles the preparations of it to a place in the depot of the Apothecary General.

The 'Indian Lancet' of October, 1860, p. 317, relates that Dr. Smirnoff recommends the *Asarum Europœum* or the irritant asarabacca in the cure of drink craving, in which he says it has obtained a great reputation in Russia. He thinks that a strong infusion of the drug, mixed with valerian or some other nervine, lowers the appetite and counteracts the invincible longings for alcohol which afflict the drunkard in the morning. He uses it in the form of the prescription given in the foot note.*

In one instance of chronic drink craving I have seen the prolonged exhibition of a pill of opium, quinine, and ipecacuanha followed by a marked diminution in the strength of the appetite. The patient to whom it was administered suffered from acute hepatitis—the consequence of over-indulgence in brandy, about five months ago. On recovery from this attack I explained to him the causes of his illness, expatiated on the disasters which must follow on a further

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|---|---|---|
| (1.) | Asarum Root | ℥ss to ʒj. |
| | Decoct. | ℥vj. |
| | Tinct. Valerian | ℥ij or ℥iij. |
| | Sydenham's Laudanum | gr. xij. |
| | Syrup of Orange Peel | ℥ss. |

**Dose.** One tablespoonful every two hours.

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|---|---|---|
| (2.) | R. Ammoniæ Carb. | ℥ss. |
| | Ant. Vini | Hj. |
| | Oxymel Scillæ | ℥ss. |

**Dose. Two tablespoonfuls every two hours. This second prescription has also, according to Dr. Smirnoff, obtained some reputation in Russia in the case of drunkenness.**

practice of his intemperate habits, and promised him release from the bondage of the appetite which for the last three years had afflicted him if he would but act up to my directions in all things. He made the promise, and I had him removed from the house where he lodged and from the society amongst whom he had contracted the habit. This done, I prescribed regular exercise, regular going to bed, regular getting up in the morning, plain food when he was hungry, no liquid at his meals until after he had finished eating, and the pill above described. The prescription has been faithfully followed, and the patient, I am glad to be able to state, is now the master of the craving of which formerly he was the slave.

Baron Liebig, in a note to his chapter on the physiological action of alcohol, alludes to several instances where the continued administration of cod-liver oil had destroyed the appetite for wines.* This is instructive, and may be turned to good account in the therapeutics of drink craving. Taken in connection with the fact that the inhabitants of and explorers in polar regions prefer oil and fat butcher's meat to grog, it appears to indicate that in some instances fats and oils may conveniently be substituted for alcohol.

It is a matter of public notoriety that teetotallers consume a larger quantity of bread and meat than is consumed by the drinkers of alcohol in some shape, and we may therefore assume that wholesome food in sufficient quantity is the most certain antidote to drink craving when it has followed on hardship and privation.

When drunkenness prevails in neighbourhoods, where the houses are ruinous, dirty, and badly ventilated, where the drainage and sewage are defective, and where pawnbrokers and publicans flourish more than butchers and bakers, we must accomplish the cure of the affection by means of the application of sanatory science rather than through moral persuasion. To exhort the inhabitants of such localities to be temperate before we let the sun and air in on their filth and misery is mockery as bitter as to invite a heavily ironed prisoner to leave his narrow cell and follow you to the green fields. Some men doubtless have preserved their virtue in the midst of darkness, dirt, and bad air, but I doubt if under similar conditions they have ever recovered it. It is absolutely certain that less drunkenness is found in residences which deserve to be called cheerful than in residences of an opposite character, and this truth ought to influence us more than it has hitherto done when we are called upon to provide accommodation for European troops in India. We supply our soldiers with more than the necessaries of life, but we do not supply them with all the necessaries of temperance. But indeed this is very difficult to do, for if we would keep our soldiers from the arrack shop, we must provide them with something more than good food, warm clothing, and a comfortable roof over their heads. In these respects the Metropolitan police are certainly not better off than European soldiers in India. Still they are much less liable to the attacks and ravages of diseases, and more temperate,* but then it is in the power of these men to possess homes, in which for a few hours daily they may shut themselves up from the rest of the world, and where they can feed their domestic affections with the sweet society of wives and children.

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* 'Animal Chemistry.'

Within certain limits one stimulant substance might be substituted for another in the cure of this affection, and when the selection rests with us it behoves us to choose that indulgence in which is followed by the least bad effects to the patient himself and to society. For instance, the consequences of intemperance in alcohol, physically, socially, and morally, are infinitely more disastrous and disgusting than the consequences of intemperance in opium are: and therefore I consider it right that in the case of the thorough-paced drunkard, when opium satisfies his appetite for stimulants it should be used freely for a time, or, if necessary, habitually. Many opium-eaters have passed and are now passing soberly through life, respectable and respected men,—men who earn their own and their children's bread, who do not offend against the laws of society or of the land, and who at last die full of years, and not necessarily destitute of honours.

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* 'Report of the Royal Commission on the Sanitary Condition of the Army,' par. 6917. Mr. Borlase Child's evidence.—"Are the City Police very sober?—They are very temperate. I am credibly informed that the Metropolitan Police are equally well behaved."

I am afraid that few drunkards will consent to accept tobacco,* tea and coffee, in the room of alcohol; still, in conjunction with other remedies, these are of undeniable use, and I think I can point to one case, where they were the main instruments of cure.

In another page of this paper I have alluded to the fact that reformed drunkards recover their juvenile tastes for sweets. When they drank hard they avoided sugar as they avoided fats, and now that they live soberly they are addicted to jams, sweet fruits, puddings, and sweetmeats. Sugar is certainly of use in the cure of drink craving; and as certain articles of diet are to be sought after, so certain other articles are to be avoided,—such articles as cheese, red herrings, and ham.

The statement of Mr. Brownlow, tailor, given on a previous page, shows how necessary sufficient ventilation is to the maintenance of temperance, as it suggests to military medical officers how important it is that they should make effective arrangements for the thorough aeration of the blood of the soldiers committed to their charge.* The evil effects of overeating and too much sleep must be counteracted by incitement to take a part in such games as cricket, Aunt Sally, bowls, skittles, and quoits. Out-door exercise evenings and mornings in the case of the European soldiers in India, on physiological grounds, is the surest way of lessening the traffic of the canteen.

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* Macnish, and even Sir B. Brodie, have affirmed that smoking leads to drinking. My observation and experience lead to quite a different opinion. I am certain that great smokers are rarely great drinkers, and *vice versâ*. Nay, more, I am sure that smoking prevents many from drinking as much as they otherwise might do.

But if, on the one hand, we weaken the appetite for alcohol by improving the general health of the patient, and the administration of medicines, we must also on the other control it by increasing the power of his will, and every agent which contributes to this result should be called into action. The lessons of religion and teetotalism should not be forgotten, while feelings of disgust for the state of brutishness into which he has fallen, of remorse for the desolate condition into which he has brought his family, of shame for the sorrow which good men lavish upon him, and of regret for his ruined finances and wasted life, should not only be excited but diligently maintained. At the same time he might be cheered with the assurance that his estate though fallen was not lost, and that by the exercise of resolution and the aids of medicine and religion, he could be freed from the bondage under which he groans, and restored to his former place in the social and human scale. In the cure and eradication of drink craving from out the land, much is still to be hoped for from the labours of teetotallers and other philanthropists, when combined with the legally authorized labours of the intelligent physician.

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* Mr. Actuary Neison is of opinion that soldiers in England are not intemperate, and he reasons thus:—classes who are intemperate suffer little from pulmonary complaints and greatly from nervous affections, but soldiers at home suffer little from nervous affection and greatly from pulmonary complaints. But I suspect that soldiers at home are not habitually intemperate, simply because they have not the means of being so, and it is not improbable that if their daily allowance of liquor was greater than it is the mortality amongst them from chest diseases would be less. The so-called intemperance amongst tailors, described by Mr. Brownlow, was perhaps more curative than destructive. (See Mr. Neison's evidence on the Report cited, par. 9317–9334.)

Before, however, very satisfactory results can be obtained from the application of the remedies mentioned, it will be necessary that the patient should be so circumstanced that they can be applied at the discretion of the physician, and independent of his (the patient's) weaknesses and caprices. This can only be the case when the victims of drink craving are legally committed to a sanatorium specially organized for their cure. The urgent necessity for such institutions has long been felt, and proclaimed by the medical profession, and their opinions begin very generally to be shared by the public at home and abroad; this, I think, can only be the prelude to a legislative Act on the subject. Last century there existed at Amsterdam a reformatory for drunken and idle people, named the Spin Huis.* It is said that many drunkard reformatories exist in the United States of America, and in Scotland similar institutions are springing up to meet the wants of society. Of one of these the eloquent Dr. Christison writes :—" Three years ago I visited, in company with a medical friend, an establishment of the kind in the Isle of Skye. It is about a mile from a magnificent rocky coast, in a sloping valley which descends from the precipitous mountain of Blaven, and it is within walking distance of Loch Corruisk, Glen Slegachan, the Spar Cave, and other rare scenery of this famous island.

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* Some six months ago, when in Amsterdam, I made inquiry about the institution, but could discover no trace of it.

The neighbourhood abounds in subjects for the pencil; there is good angling in all directions; an interesting botany, a rare geology, and no want of material for the fowler and ornithologist. The proprietor is a well-informed medical man, and also cultivates a farm. In summer and autumn he receives not a few visitors, who intermingle on a footing of equality with the inmates, so that these are by no means cut off altogether from ordinary society. Whisky may be had by walking twelve miles of a good road, but no nearer, and only by deceiving the solitary spirit-dealer of the place, who is under promise not to supply any of the anchorets of Strathaird; or it may be got fourteen miles off, by a road so rugged that a fair pedestrian may do it in five hours. Here we found ten gentlemen—cases originally of the worst forms of ungovernable drink craving—who lived in a state of sobriety, happiness, and real freedom. . . . Radical cures are rare among them, for such men, under the present order of things, are generally too far gone in the habit of intemperance before they can be persuaded to submit to treatment. Nevertheless one of those I met there—a very hard case indeed—has since stood the world's temptation bravely for twelve months subsequently to his discharge; and the proprietor informed me of another having been, at the time of my visit, at liberty and sober."* I find the following passages in the Report of the Royal Lunacy Commission for Scotland:†—"There is one form of insanity, namely, that which results from, or is connected with over-indulgence in intoxicating liquors, which demands some special observations. During the course of our investigations we have frequently observed the difficulties that attend the treatment of such cases. . . . In the evidence which was given before us, various suggestions are made to meet this crying evil, but they all resolve themselves into the recommendation to deprive the patient of his liberty for a period sufficiently long to allow the system to accommodate itself to the want of stimulants, and thus to enable the patient to resist the morbid craving which their withdrawal produces. . . . The necessity of the case has in the meantime led to the establishment of particular houses, in some of which patients are received at their own request, while in others they are placed by their friends, and illegally detained by force. . . . From a consideration of the above facts it appears to us highly important that some plan should be devised whereby a degree of authority might be legally retained over such cases, allowing at the same time a certain amount of freedom." Dr. Macleod, the director of the very excellent establishment at Ostaig House, Isle Oronsay, Skye, writes to me very cheeringly of the affection to which he devotes his time. He says, "To prevent idleness, every one is encouraged during the day to occupy himself with fishing, collecting objects of natural history, gardening, or with some manner of work, so as to exercise alike the mind and the body. . . . Spirits, wines, and malt liquors are entirely forbidden. In every case I have found it necessary to treat the stomach weakness, and other derangements of the system, by means of iron and nitro-muriatic acid. Regarding the results, almost in every case* I have had the pleasure of seeing my patients restored to society and conducting themselves respectably."† These extracts prove the necessity for, and the practicability and utility of sanatoria for the cure of drink craving. In the European army in India there are many men chronic drunkards, and who on this account pass their lives as patients in the hospitals or as prisoners in the guard-room; they do no duty, and are sources of great expense to Government, of considerable trouble to their officers, and moral pests amongst their comrades. The discipline and efficiency of regiments would be materially increased if such men were weeded out of them, and I would suggest to Government the advisability of establishing a sanatorium in India for the reception and cure of such characters. This might be located in the hills, and for financial as well as sanatory reasons, take the shape of a tea plantation. Here daily toil in the open air would be one of the main conditions of the inmates' lives, and regarded as a powerful means of cure; for active out-door occupation, regularly followed, brings in its train blessings and rewards which cannot otherwise or with such certainty be come by. These are muscular strength, good digestion, a pleasant weariness of body, sound sleep, and a certain placidity of mind which in its reaction on the body is eminently friendly to physical health.*

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* 'On some of the Medico-Legal Relations of the Habit of Intemperance,' pp. 40–42.

† Pages 242, 243.

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* Dr. Macleod only receives those patients into his house in whom the affection is of short standing.

† Extracts from private letter.

Perhaps a not unsuitable site for an institution of this nature might be found at Kangra. This district is in a province where a large proportion of the European troops of Bengal are cantoned; it possesses a good climate, and offers large tracts of arable ground where tea, grain, and vegetables could be grown, and flocks reared at remunerative prices; and I believe that if properly directed and applied here, the labour of these drunkard soldiers would in time not only clear the current expenses, but the original cost of the institution (see estimate appended).

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* Mr. Neison, in his evidence before the Royal Commission which investigated the sanitary condition of the army, is eloquent in recommending out-door exercise as a means of health. He attributes the frequency of pulmonary complaints amongst soldiers to an insufficiency of this exercise; and it is also, he says, the cause of the small mortality amongst agricultural labourers, who are as poorly fed, clothed, and housed, as anybody. (See the Report, p. 320, and Appendix, lxxi.)

Many still hold the opinion that partly on account of the climate, partly on account of the cheapness of native labour, the value of the labour of Europeans even in the hill country of India would not equal the cost of supplying their necessary wants. I believe that experience acquired during the mutinies of 1857, and of indigo planters, extending over a century, and the circumstances under which the ordinary life of white men is pursued in the Southern States of North America, demonstrate this to be a fallacy.

If I am right—as I believe I am—that idleness, overeating (a frequent consequence of idleness), too much sleep, and the relaxing climate of the plains in the rainy season, are the most common causes of drink craving in India, then industrious occupation on a tea plantation situated on the slopes of the Himalayas at an altitude of from 4000 to 5000 feet above the level of the sea, would, in addition to removing the patients from the influence of these causes, afford to their bodies an opportunity of returning to that state of health which is the only safeguard against the attacks of the malady from which they suffer.*

The Act rendering such an institution legal would also provide for the residence of wives and daughters, with the men during their sojourn there; for, besides the beneficial influence which the society of women and children exercises on men generally, the services of the women would be required in the kitchen, the laundry, and sewing-room, and the children would have the priceless advantages of being educated in a climate favourable to their physical development, and to the eradication or amelioration of those constitutional defects which the children of drunkards too often inherit from their parents.

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* I hope that before long the progress of the question will induce Government to appoint a Commission to inquire into the causes of drunkenness amongst European soldiers in India, as already has been done in the case of cholera.

A supplementary clause entered in the Articles of War, and approved of by the Legislature when these are annually submitted to be passed, would render such a sanatorium legal; but to the attainment of an end so desirable the approval of the chief military authorities here and at home, of the Crown lawyers and both Houses of Parliament, would be necessary.

I should hesitate to recommend the authorities to send any but incorrigible drunkards to this sanatorium,—men on whom the military cures of habitual drunkenness had been tried in vain, and whose daily conduct indicated that in virtue of the circumstances in which they were placed, there existed some physical obstruction barring their return to habits of sobriety. This condition would render the path to the sanatorium a thorny one, and so act as a check to any desire which might be cherished to enter it through the door of malingering, as it would secure to all real patients the benefits which are occasionally derived from corporal and other punishment.*

In time it might be thought advisable to pay the inmates a supplementary salary of from one to five rupees per mensem according to the conduct and the labour which they did, and a savings-bank would be established for compulsory and voluntary deposits, out of which they would be called upon to defray the cost of their clothes, their washing, their books, their amusement, their room, and of their transit to and from the plantation. The women would be paid according to their labour, and the children, in return for such work as they could render, would be allowed clothes, food, and education.

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* It is difficult to say how far corporal punishment, as a means of strengthening voluntary control, may not be good in the earlier stages of drink craving; doubtless it is often followed by good effects, but in the later stages I believe it to be not only useless, but downright cruel. This question, however, affords a broad arena for discussion, inasmuch as it affects the treatment of crime generally; and on this account persons who hold different opinions with reference to it, ought to exercise great forbearance towards others.

The direction of the institution would be entrusted to a medical officer, assisted by one sergeant as house steward, by a second sergeant as farm steward, and by a soldier's wife as matron. The co-operation of these officials, combined with the energy, decision, and common sense which the superintendent should possess, with that moral force arising from respect for the habits of order, obedience, and industry, which it would be necessary to interweave with the growth of the institution; and with the assistance received from such convalescent patients as could be trusted,—would, I feel sure, be found sufficient for the control and direction of the inmates under all circumstances. Police assistance could thus be dispensed with in working the machinery of the establishment, although it would be required to maintain the integrity of that boundary line across which no liquor could be brought without the sanction of the superintendent. It would be for the supreme Government to decide how much power should be delegated to the superintendent, and to whom he should be accountable.

It would be a fundamental law of the establishment, that the natives of the country should be altogether excluded from the limits of the plantation, with the double object of preventing smuggling in liquor, and of providing the inmates with occupation even during their leisure hours.

The institution would receive the active support of the law; and it might be found necessary to render the unauthorized transport of alcohol across the boundary line a felony.

The above is merely an outline—an outline which, while it conveys a correct idea of the main features of the institution aimed at, would doubtless require many minor modifications before that institution could be brought into efficient operation. And it will be observed, that in the cure of chronic drink craving amongst soldiers in India, I would mainly trust to means which when used in ordinary civil life lead to health, contentment, and sometimes to wealth,—namely, active out-door employment, regular habits, a sufficiency of wholesome nourishing food, good lodging and appropriate clothing, and those auxiliary means which are found to be most powerful to eradicate old habits, namely, change of occupation, change of scene, and absence from those circumstances and their associations amongst which the habit was originally contracted and subsequently practised.

Before concluding this paper, I will briefly allude to the principles of total abstinence. Doubtless they and their advocates have in their time done much good, still I cannot believe that their application is altogether unaccompanied with evil. Their votaries eschew drinking alcohol, but they find their grog—as it is vulgarly expressed—in doing other things, which are not always innocuous to society. Thus I have often observed that some teetotallers* are great scandalmongers; that others, in virtue of the abstinence which they practise, are vain of and ostentatious about their superior goodness; and others, again, are excessively libidinous†—pickpockets are so, and they are exceedingly temperate. I have found natural teetotallers as a whole to be selfish, uncharitable, and badly qualified for the offices of friendship.

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* I do not speak here of reformed drunkards, but of those others who profess and follow the doctrines of teetotalism, for other reasons than that they cannot resist taking too much when they take a little.

† "It is a singular fact that, as a body, the pickpockets are generally very sparing of drink. They are mostly libidinous, indeed *universally* so." (Mayhew's 'London Labour and London Poor,' vol. iii. p. 315.)

But there are various classes of them, and the majority are teetotallers only in name; for when they are not great smokers, they are most probably great tea-drinkers, great swillers of ginger-beer, or great gluttons. I hope to live to see Great Britain more temperate than at present, but never teetotal. If we possess a faculty which discovers and appreciates alcoholic beverages and other stimulating substances, it is but right that it should be temperately exercised.

NOTE.—"Then I saw in my dream that these good companions, when Christian was gone to the bottom of the hill, gave him *a loaf of bread, a bottle of wine, and a cluster of raisins;* and then he went on his way."—'*Pilgrim's Progress,*' *Christian leaving Palace Beautiful.*

In the following estimate I have—

1. Estimated the value of one European's labour as equal to 2½ natives: nor do I consider this to be an over-estimate, when we know that eighteen persons and ten horses are sufficient for the cultivation of an arable farm of 500 acres in Scotland.

2. I have calculated the average salary and board of each

| | | | | | |
|---|---|---|---|---|---|
| Man | at | 25 | rupees | per | mensem. |
| Woman | „ | 15 | „ | „ | „ |
| Child | „ | 10 | „ | „ | „ |

This scale would, I think, be very liberal, as many of the necessaries of life would be raised on the plantation at little cost; and as each would be called upon to pay for his own clothing and washing out of his monthly salary, except the children; but these, again, receive no salary.

3. I have omitted all mention of the interest of that money expended on building barracks, offices, etc., as payment of it is provided for elsewhere.

*Approximate Estimate of expenditure incurred in planting and cultivating* 100 *acres of land attached to a Reformatory for* 180 *soldiers convicted of habitual drunkenness, extending over eight years, and of the return,—the work of the plantation and reformatory being entirely carried on by these men, and the ten women and twenty-five children who are supposed to have accompanied their husbands and fathers to the Reformatory (calculated from Dr. Jameson's Tables.) (See 'Selections from the Records of Government,' No. XXIII.)*

*Cr.*

| | | |
|---|---|---|
| 3rd year, lb 8,000 at Rupees 1 per lb ... | 8,000 | |
| 4th „ from sale of tea ... ... ... ... | 18,000 | |
| 5th „ „ „ ... ... ... ... | 26,000 | |
| 6th „ „ „ ... ... ... ... | 50,000 | |
| 7th „ „ „ ... ... ... ... | 78,000 | |
| 8th „ „ „ ... ... ... ... | 95,000 | |
| | | 2,75,000 0 0 |

*Dr.*

| | | |
|---|---|---|
| 1. Wages and board for 52 men ... ... ... | 15,600 | |
| Implements ... ... ... ... ... ... ... | 700 | |
| | | 16,300 |
| 2. Wages and board for 54 men ... ... ... | 16,300 | |
| Implements, etc. ... ... ... ... ... ... | 800 | |
| | | 19,000 |
| 3. Wages and board for 59 men ... ... ... | 17,200 | |
| Wood for boxes, etc. etc. ... ... ... ... | 800 | |
| Building a factory ... ... ... ... ... ... | 4,000 | |
| | | 22,000 |
| 4. Wages and board for 75 men ... ... ... | 22,500 | |
| Land rent, boxes, etc. etc. ... ... ... ... | 1,800 | |
| | | 24,300 |
| 5. Wages and board for 84 men ... ... ... | 25,200 | |
| Carriage, rent, boxes, etc. etc. .. ... ... | 3,000 | |
| | | 28,200 |

| | | |
|---|---|---|
| 6. Wages and board for 100 men | 30,000 | |
| Carriage, rent, boxes, etc. etc. | 4,600 | |
| | | 34,600 |
| 7. Wages and board for 135 men | 40,500 | |
| Rent, carriage, boxes, etc. | 10,000 | |
| | | 50,500 |
| 8. Wages and board for 180 men | 54,000 | |
| Rent, carriage, etc. etc. | 3,000 | |
| | | 57,000 |
| Salary of Superintendent for 8 years | 96,000 | |
| „ of 1 Sergeant for 8 years | 14,400 | |
| „ of 1 Sergeant for 4 years | 7,200 | |
| „ of 1 Matron for 8 years | 9,600 | |
| | | 1,27,200 |
| Wages and board of 10 women for 8 years | 14,400 | |
| Education and board of 25 children | 28,800 | |
| | | 43,200 |
| Interest on expenditure over income for 8 years | | 19,100 |
| Furniture for Institution | | 20,000 |
| | | 4,59,400 |

| | |
|---|---|
| Total expenditure over 8 years | 4,59,400 |
| „ income | 2,75,000 |
| | 1,84,400 |

| | |
|---|---|
| Interest on 1,84,400 at 5 per cent. per annum | 9,228 |

| | |
|---|---|
| Annual rental on and after 8 years | 95,000 |
| „ expenditure on and after 8 years | 78,600 |
| | 16,400 |

| | |
|---|---|
| Annual profits of estate | 16,400 |
| Interest on debt as given above | 9,228 |
| Clear rental, rupees | 7,142 |

| | |
|---|---|
| Probable value of the plantation, if worked by natives after the 8th year | 7,00,000 |
| Debt | 1,84,400 |
| Government gains by the transaction | 5,15,600 |

# DIFFERENCES IN MEN.

(*Published in the 'Indian Annals of Medicine,'* 1863.)

In alluding to man, we commonly speak of him as composed of a framework of certain tissues in which certain fluids are contained, and of a certain unknown essence which we name "mind." The former are his material, the latter his immaterial, part. The former are visible and tangible, the latter can only manifest its presence through the intervention and agency of matter. It is commonly admitted—but whether the doctrine is commonly believed I cannot say,—that mind can act independently of matter. Investigating this abstruse question as human and reasonable beings, and by the aid of science, we can discover no sure grounds, or, I should rather say, *no* grounds on which to rest this opinion. In the present stage of our development towards perfection, I think it would be wise to assume this doctrine to be correct; but, on the other hand, I think it would be equally wise to admit it as an axiom, that so far as this life and this globe are concerned, mind can only operate through the material part of man; and that, influenced by, and influencing the whole tissues of the body, its special seat and organ is the brain. We have much to show towards proving that this doctrine is true, and nothing, which is not based on pure speculation, to show that it is not. When the brain of a man is seriously concussed or compressed, the operations of his mind cease to be manifest. If we decapitate an animal, all its subsequent movements indicate life certainly, but not that higher kind of life which, we believe, resides only in the brain. When that organ is diseased, the manifestations of mind become irregular; and according to the combinations in which these irregular manifestations appear, they indicate the presence of the different forms of insanity, of mania, monomania, dementia, and moral insanity. When the brain is malformed or deficient in quantity from birth, and its tissues of an inferior quality, then the mental operations are so feeble and so irregular, that we name the person in whom they appear, an idiot. And as it is with the whole brain, so it is with portions of the brain.* Physiologists may think that Gall and his followers have failed to show whereabouts in the brain each of our mental faculties resides; still, they as a body believe the principles taught by those illustrious men to be in the main correct; that is, they believe that each immaterial faculty has its own material habitat or organ, well defined by nature, but not yet discovered by man; and that differences in the manifestations of the mental faculties depend on, or arise from differences in the size or in the quality of these organs or habitats. There is nothing in physiology or in pathology, so far as I know, which controverts this theory, and much in both which supports it. Moreover, this theory explains many of those problems and apparent inconsistencies in nature which disturbed and distracted the philosophers of antiquity; and further, it is in strict accordance with the moral constitution of man, as has been shown so ably and piously by Mr. George Combe.* By a reference to it, we at once understand why one man is more proud, more ambitious, more avaricious, and so on, than another, and why the virtues of a good man should, by contact with physical suffering, degenerate into the rank vices of a bad man.

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* Von Bibra found that different portions of the brain contain different proportions of phosphorus. (See Day's Phys. Chemistry, p. 412.) "Different portions of the same brain vary much in their specific gravities. The specific gravity of the cerebrum is different from the specific gravity of the ganglia at the base of the brain, and the specific gravity of those in turn from the specific gravity of the cerebellum. Nay, further, different portions of these divisions of the great central organ differ remarkably in their specific gravities. I base these remarks on experiments."

As a consequence of believing what I have above written, I regard the following statements in the same light as mathematical scholars regard certain other statements which they believe to be axioms:—

1. That the body (and more peculiarly the brain) is the organ of the mind.

2. That the mind can manifest its presence, and as far as this life and this globe are concerned, can operate only through the instrumentality of the body; and on the whole that the mental capacity is in proportion to the size and quality of the brain.†

3. That changes in the tissues of the body precede, and induce through precession, changes in the manifestations of the mind. When I say precede, I do not mean to say, or even to insinuate, directly or indirectly, as Condillac‡ appears to have done in the days when physiology was far less advanced than it is now, that our faculties are but the result of our impressions; for I believe that the brain of an infant is endowed with capacities and tendencies which impressions made by external things may modify and direct, but which they never can create.§

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* 'Moral Constitution of Man.'

† The brain of the Hottentot Venus weighed little more than half of Cuvier's brain, or, as I am told, of Thackeray's.

‡ 'Treatise on the Sensations.' For a lucid synopsis of the leading features of Condillac's philosophy, see Buckle's 'Civilization in England,' vol. i. pp. 793–796.

§ I do not pretend to touch on the varied operations or functions of

4. That the body is in a degree subject to, and liable to be changed by everything external to it. This last proposition completes the chain which connects the mind of man with the material universe, and in our studies carries us back into the minute structure of matter which first received the breath of life, and where the so-called mysteries of life lie hidden.

And so it is that the history of man, in his crimes, his wars, his social institutions, his legislative enactments, and so on, is the science of the operations of mind and brain. And it would further appear plain that the key to men's conduct (that is, the reduction of all mental phenomena to the order of an exact science) is to be found in the study of the relations which the human tissues bear to the things and forces by which they are surrounded. This is of course the physiology, not of man, or of animals merely, but of universal matter; or, in other words, that science which is to result from the fusion of all sciences into one. Many centuries shall roll away before this consummation can be reached, but that it will be reached is, as it were, an article in the belief of the scientific men of the present day; and the physiologist, the astronomer, the chemist, the psychologist, the geologist, the physical geographer, and the meteorologist, feel that, one and all, they are cutting their several ways through much darkness and many difficulties

the brain, which, as considered in a single individual, constitute metaphysics, or in men generally, which constitute history in its widest sense. All I contend for is, that the brain can only be called into action by impressions made on it by things external to it. When so called into action, it will act in a manner corresponding to its structure. But while I admit this, I believe that within certain limits its structure can be changed more or less according to the degree of intensity in which the causes of change are applied to it, and to the intensity of strength of the tendencies and capacities which it has inherited.

towards one common centre, where, in the general congress of sciences, they will pour their separate treasures into one common treasury, to form one grand and complete whole, which will constitute universal physiology. The time is not yet, but I believe it to be approaching, when, with visible and tangible apparatus, we shall be able to gauge man with as much ease as we now gauge planets, and to predict his behaviour with as much certainty as we now foretell the advent of eclipses and the movements of the planets.*

Comparative physiology, as at present understood, is the name which has been given to that science which treats of the differences in function and structure between the different species of organized beings. It is now a science of great breadth, and to it we owe the exposition of that priceless truth that man draws his superiority over other animals from the superior size and quality of his brain. When this science, however, has expanded into that higher physiology to which I have alluded, and which in its comprehensiveness will treat of the differences in function and structure observable in the different members of the same family or species, then it shall be seen that it will teach us truths of even greater importance than this. For, disclosing also the material differences which characterize men, it will render it plain why men in their tempers and mental manifestations differ at different times; why men are so toned that we speak of them as masculine, and women that we speak of them as feminine; why one man is brave and proud, and another man is cowardly and vain; why it is natural for one person to be virtuous, and for another person to be vicious; and why one man is named a Negro, a second a Malay, a third an European, and so on. I say so, because it appears to me to be necessary to believe that all these differences must have their origin in differences of material constitution. That man is a sanguine man, and this man is a Frenchman, and yonder man is a man without guile, in virtue of his anatomical and physiological peculiarities, just as this is a madman; that is a leper, and yon is a cholera patient. It this direction, it appears to me, lie the future triumphs of physiology. Here is a vast tract of knowledge, as yet almost unbroken by the minds of men. Like the far-reaching regions of space, it stretches farther than the eye can see or the imagination compass, and we are as yet but travellers and settlers on its hither boundary. Here, indeed, is the great ocean of undiscovered truth, and the children gathering pebbles on its shore.

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* With the tables of M. Quetelet to enlighten me, it is, I think, asking less of me to believe this than it would have been to have asked a British savage 1864 years ago to believe that in the 1864th year of the Christian era, we should be able to travel at the rate of seventy miles an hour; to communicate with people hundreds of miles away in a few seconds; to do our arithmetic by machinery (Babbage's); to pronounce what metals exist in the sun ninety or one hundred millions of miles distant from us (Professor Tyndall on 'Heat as a Mode of Motion,' pp. 414, 415), and to weigh the planets as in a balance.

## RELATIONS OF FUNCTION TO STRUCTURE.

I have said that the brain being the instrument of the mind, or the medium through which the mind manifests itself, it follows that mental manifestations must depend for their character on the medium through which they are made, just as light does when transmitted through glass. This is also true of the functions of other tissues, of the muscular, the secreting, the excreting, etc. Science is now so far advanced as to enable us to state it as a fundamental truth, that function and differences in function originate in structure and differences in structure.* In more ignorant times this

* A reviewer in the 'Lancet' of the 13th August, 1864, says, with reference to Handfield Jones's observations on functional nervous

connection was not recognized, and so it came to pass that "function"—in some instances, at least—was regarded as something altogether independent of structure, and that the older works on physic speak of some diseases as organic and of other diseases as functional. In these days, when we cannot trace the so-called disordered function to structural change, we merely regard our inability to do so as a measure of our ignorance, and not as a proof that the disorder is of a purely "functional" nature. A history of the various nervous affections illustrates what I mean.

## CLASSIFICATION OF DIFFERENCES.

It may be a long time before we shall be able to trace with certainty all differences in our mental capacities to differences in the structure of our bodies; still, on this account

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diseases:—"This is eminently a clinical and practical work, but the word in the title-page to be emphasized is the word functional. *He* writes with a great purpose who aims at enlarging our conception of the possibility of grave morbid phenomena having a merely functional origin." Further on, the same writer says, "The state of fever (a functional disease) he (Handfield Jones) considers to be explicable on the supposition of what he calls a paretic condition of the sympathetic." The writer does not appear to see that the phrase 'paretic condition' implies, whatever else it may imply, a change in the structure of the sympathetic nerve where the condition exists. We first have the agent producing the condition, then the action or function arising from that condition. If diseased function does not depend on changes in the structure of our tissues, then why administer medicine to correct the erring function? Can matter impress, though immaterial? The truth is, so gross are we still, that the alterations in structure which we cannot see and handle (as, for instance, enlarged liver, tubercle in the lungs, etc.) and weigh, are apt to be regarded by us in their manifestations as purely functional diseases. Of course, when asked to define what we mean by a functional disease, we are dumb. To revert to the old custom of speaking of any disease as functional, is to revert in some degree to the *metaphysics* of medicine.

we are not to be frightened from our belief that all mental differences have this origin, nor hindered from investigating and recording, in consequence of this belief, the material differences which abound in the members of the same species when compared the one with the other. As I have above stated, we know that the mental capacity is in direct ratio to the size and quality of the brain; that if we destroy the brain, we have no mental manifestation; that if the brain tissues are constituted in a certain way, its functions are collectively spoken of as idiocy; and that when the organ undergoes certain other changes, we see the displays of insanity. These are strong grounds on which to base the theory expressed above, and I think the grounds on which Newton rested his theory of the attraction of gravity, or Dalton his of atomic weights, were not more secure. The differences which I will record in this paper are small in number, and to many their nature may appear to be unimportant; but, to any objections which may be made on these scores, I will answer that this fragment of science is still in its immaturity, and that everything must have a beginning.

The tissues of the body may differ in two ways, as I have already stated; first, in quantity, and second, in quality. Thus I have, on two occasions at least, clearly found after death that the brain of A weighed more than the brain of B, notwithstanding that in their lifetime B was, I think, justly regarded as intellectually superior to A. The apparent anomaly is, I think, to be explained by attributing the intellectual superiority of B to a superiority in his brain tissues. So also in the muscular tissues; a man whose muscles have undergone fatty degeneration is muscularly weaker than he whose muscles are in good condition, although the aggregate weight of the former's muscular tissue may be greater than the aggregate weight of that of the latter. The feeble action of the fatty heart, and the greater specific gravity of the muscles of the bull's neck when compared with the muscles of the cow's neck, or of the cock's leg, when compared with the muscles of the hen's leg, are illustrations of these statements. In my opinion, the differences in *quality* of the tissues have not been sufficiently taken into account hitherto by phrenologists and physiologists. That the same tissues in different bodies are present in different quantities is a very well known fact: the writings of anatomists prove it abundantly. I will now speak of these differences under the heads national differences, sexual differences, differences characteristic of age, and temperament differences.

## NATIONAL DIFFERENCES.

While much has been written on the anatomy and general appearances of different races of men to prove, on the one hand, that they have sprung from the same stock, and, on the other, that they have sprung from different stocks,* little, or, I should rather say, nothing has been written descriptive of those minute structural differences on which, I believe, the peculiarities of nations depend. Seeing that the natives of Lower Bengal differed from Europeans in colour, I instituted some investigations during last autumn to determine whether these people also differed in specific gravity, in temperature, and in the constitution of their bloods. The subjoined Tables show the result of these investigations:—

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* The anatomical differences hitherto noted in distinguishing the different races of men may be referred to the following heads:—conformation of the cranium, conformation of the pelvis, conformation of other parts of the skeleton, colour of the skin, colour, texture, and mode of growth of the hair. (Cyc. Anat. Phys., vol. iv. pt. ii. p. 1319.)

## SPECIFIC GRAVITY OF EUROPEANS.

| Occupation. | Heat of Atmosphere. | Heat of Water. | Weight of Body. | | | Weight of Water displaced. | | | Remarks on Condition. |
|---|---|---|---|---|---|---|---|---|---|
| | About | About | S. | lb. | oz. | S. | lb. | oz. | |
| 1. Old soldier | 86° | 86°<br>86° | 9 | 0 | 6 | 9 | 3 | 4 | Old, convalescent from severe fever. |
| 2. Boy | 86° | 86° | 5 | 5 | 0 | 5 | 6 | 8 | Delicate boy. |
| 3. Fitter | 86° | 86° | 9 | 5 | 4 | 9 | 3 | 15 | Young and healthy. |
| 4. Ditto | 86° | 86° | 11 | 9 | 0 | 11 | 5 | 8 | Ditto ditto. |
| 5. Ditto | 86° | 86° | 8 | 9 | 8 | 8 | 8 | 3 | Ditto ditto. |
| 6. Ditto | 86° | 86° | 9 | 5 | 2 | 8 | 13 | 7 | Middle-aged, thin and wiry. |
| 7. Ditto | 86° | 86° | 8 | 12 | 12 | 8 | 6 | 0 | Middle-aged, healthy. |
| 8. Blacksmith | 86° | 86° | 11 | 13 | 0 | 11 | 12 | 12 | Middle-aged, fat but active. |
| 9. Fitter | 86° | 86° | 11 | 2 | 8 | 10 | 9 | 7 | Young, muscular, and just out from England. |
| 10. Ditto | 86° | 86° | 10 | 12 | 0 | 10 | 6 | 0 | Young and healthy. |
| 11. Ditto | 86° | 86° | 10 | 8 | 4 | 10 | 7 | 8 | Ditto ditto. |
| 12. Ditto | 86° | 86° | 8 | 13 | 2 | 8 | 12 | 14 | Ditto ditto. |
| 13. Ditto | 86° | 86° | 10 | 6 | 4 | 9 | 13 | 7 | Ditto ditto. |
| 14. Driver | 92° | 86° | 8 | 13 | 10 | 9 | 0 | 6 | Both healthy, these were tested in the evening of a very hot day in June. |
| 15. Ditto | 92° | 86° | 10 | 13 | 6 | 11 | 0 | 0 | |
| | | | 146 | 3 | 2 | 143 | 7 | 0 | |

Mean Specific Gravity, 1·018.

## SPECIFIC GRAVITY OF THE NATIVES OF BENGAL.*

| Occupation. | Heat of Atmosphere. | Heat of Water. | Weight of Body. | | | Weight of Water displaced. | | | Remarks on Condition. |
|---|---|---|---|---|---|---|---|---|---|
| | About | About | S. | lb. | oz. | S. | lb. | oz. | |
| 1. Hospital bearer | 86° | 86° | 7 | 8 | 12 | 7 | 8 | 2 | Young, muscular, and well-fed. |
| 2. Ditto. | 86° | 86° | 7 | 9 | 8 | 7 | 9 | 6 | Ditto ditto ditto. |
| 3. Carpenter | 86° | 86° | 8 | 13 | 12 | 9 | 0 | 4 | Middle-aged, fat, healthy. |
| 4. Hospital bearer | 86° | 86° | 9 | 0 | 4 | 9 | 0 | 1 | Young, muscular, and well-fed. |
| 5. Ditto. | 86° | 86° | 7 | 2 | 4 | 7 | 2 | 2 | Ditto ditto ditto. |
| 6. Chuprassie | 86° | 86° | 8 | 4 | 11 | 8 | 2 | 2 | Healthy, middle-aged. |
| 7. Ditto | 86° | 86° | 7 | 6 | 6 | 7 | 8 | 11 | Middle-aged, lean, healthy. |
| 8. Ditto | 86° | 86° | 6 | 5 | 11 | 6 | 4 | 9 | Ditto ditto. |
| 9. Clerk | 86° | 86° | 8 | 2 | 8 | 8 | 4 | 3 | Young, muscular, healthy. |
| 10. Water-carrier | 86° | 86° | 7 | 13 | 14 | 8 | 0 | 9 | Old, muscular, well-fed. |
| 11. Blacksmith | 86° | 86° | 7 | 12 | 11 | 7 | 10 | 3 | Young, muscular, well-fed. |
| 12. House bearer | 86° | 86° | 7 | 0 | 2 | 6 | 13 | 4 | Ditto ditto ditto. |
| 13. A Boy | 86° | 86° | 5 | 5 | 13 | 5 | 8 | 3 | Well, but badly-fed. |
| 14. Ditto | 86° | 86° | 5 | 12 | 8 | 5 | 10 | 14 | Well-fed and healthy. |
| 15. A Cooly | 86° | 86° | 7 | 12 | 12 | 7 | 11 | 11 | Young and muscular. |
| | | | 112 | 13 | 8 | 112 | 10 | 14 | |

Mean Specific Gravity, 1·001.

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* The specific gravity of the water was taken, and allowances made for the matter which it contained, rendering its specific gravity greater than 1.

## *Degrees of Heat in the mouths of Bengalees and Europeans.*

### BENGALEES.*

Temperature of the Atmosphere, 79°.

| Occupation. | State. | Condition. | Temperature. | Race, etc. |
|---|---|---|---|---|
| Compounder of Medicine . . | Gentle exercise . | Healthy, lean . | 96·5° | Hindoo; diet mainly farinaceous; drinks occasionally and smokes. |
| Ditto . . . . | Ditto. | Ditto. | 97° | Mahomedan; diet mixed; drinks and smokes. |
| Carpenter . . . | After a short walk. | Excellent . . | 96·5° | Hindoo; diet mainly farinaceous; smokes. |
| Bearer . . . . | Active exercise for two hours. | Good . . . . | 98° | Hindoo; diet mixed; smokes. |
| Native Doctor . | Seeing and prescribing for patients for two hours. | Ditto . . . . | 98° | Mahomedan; diet mixed; smokes. |
| Hospital Bearer. | Active exercise . | Lean, healthy . | 96·5° | Hindoo; diet mainly farinaceous; smokes. |
| Writer . . . . | Walking exercise | Good . . . . | 97·5° | Ditto, ditto, ditto. |
| Hospital Bearer. | Active exercise . | Ditto . . . . | 98° | Hindoo; diet mixed; smokes. |

Mean, 97·25.

### EUROPEANS.

| | | | | |
|---|---|---|---|---|
| Surgeon . . . | Gentle exercise . | Good . . . | 98·5° | Scotch. |
| Sailor . . . . | Ditto | Ditto . . . | 98·5° | English. |
| Ditto . . . . | Ditto | Ditto . . . | 99·5° | Scotch. |
| Ditto . . . . | Ditto | Ditto . . . | 100° | English. |
| Ship Master . . | At rest . . . . | Ditto . . . | 98° | Ditto. |
| Ship's Mate . . | Ditto | Ditto . . . | 98·5° | Scotch. |
| Surgeon . . . | Gentle exercise . | Ditto . . . | 97·5° | Dutch. |
| Guard . . . . | At rest . . . . | Ditto . . . | 99° | Canadian, born of Europeans. |

Mean, 98·68.

These temperatures were all taken in the course of an hour and a half, in the same place, after sleep, and, I think, in all instances before breakfast. The bulb of the thermometer was applied over, not under the tongue.†

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* Dr. Davy ('Physical and Anatomical Researches,' vol. i. pp. 162–180) gives a detailed account of his inquiry into the temperatures of different races of men. On the whole, the results of my experiments are in keeping with the results of his. It is, however, impossible to compare his tables satisfactorily, as the subjects compared were not operated on at the same time, nor under the same circumstances.

† The men experimented on, both native and European, varied in age from 18 to 35.

*Analysis of the Blood of Bengalees.*

|  | Fibrin. | Solids of the Serum. | Corpuscles. | Water. | In what number of parts. | Remarks. |
|---|---|---|---|---|---|---|
| 1 | 2·216 | 88· | 123·538 | 786·246 | 1,000 | From a Bearer; muscular; feeds on rice chiefly. |
| 2 | 2·904 | 120·000 | 108·639 | 768·457 | 1,000 | Tavern-keeper; eats flesh; smokes, but does not drink. |
| 3 | 2·000 | 114·142 | 107·008 | 776·850 | 1,000 | Ditto as above. |
| 4 | 2·920 | 104·000 | 106·489 | 786·591 | 1,000 | Policeman; eats fish and butcher meat when he can get it; smokes tobacco. |
| 5 | 2·235 | 102·000 | 118·402 | 777·363 | 1,000 | Policeman; eats rice, dhall, milk, and occasionally meat; smokes tobacco; does not drink. |
| Mean[*] | 2·463 | 105·628 | 112·815 | 779·102 |  |  |

These analyses were made after the method of Andral and Gavarret, as described by Simon in his 'Animal Chemistry' at the beginning of his section on the pathological chemistry of the blood, and by Mr. Bowman in his 'Medical Chemistry.'

The following is the mean analysis of the blood of Europeans, from the experiments of Becquerel and Rodier, who also followed the method adopted by Andral and Gavarret:—[†]

| Fibrin. | Solids of the Serum.[‡] | Corpuscles. | Water. |
|---|---|---|---|
| 2·2 | 79·4 | 141·1 | 799·0 |

The first tables tend to show that the specific gravity of Europeans is greater than that of Bengalees. The European being more energetic than the native, this difference might have been predicted.

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[*] I used the chloride of calcium bath for drying purposes, but I cannot help suspecting that I did not succeed in driving off all the water from the serum, when I compare my table with that given from Becquerel and Rodier, and with tables given by others.

[†] 'Simon's 'Animal Chemistry' (Old Sydenham Society edition), vol. i. p. 233.

[‡] In the solids of the serum I include fat, extractive matter, and salts, which are given separate by Becquerel and Rodier.

The second table shows that the average temperature of the bodies of Bengalees is lower than the average temperature of the bodies of Europeans. It may be objected that this experiment is not conclusive, inasmuch as it only gives the comparative temperatures of mouths. But although I have only introduced the one table that the text might be the clearer, still I have tested the accuracy of the impression to be gathered from it, by experiments on the skins, the urine, and the rectums of other natives and Europeans.

The third table, as far as it goes, shows that the blood of the Bengalee contains more albumen and fewer red corpuscles than the blood of the European, as analysed by Becquerel and Rodier, Le Canu, and others. What does this poverty in corpuscles indicate? The blood of animals low in the scale, say of molluscs, contains no red corpuscles. As we ascend the scale, these begin to make their appearance in small proportions, as in the lower fishes and reptiles; next in greater proportions, as in the higher fishes and reptiles, and so on until they attain their maximum proportions in carnivorous animals and birds. This gradual increase appears to indicate that there is some direct connection between the number of the red globules and superiority or inferiority of organization. Andral and Gavarret observed that an increase in the red corpuscles accompanies an improvement in the breed of animals.* Depletion and starvation have a contrary effect.† Again, these corpuscles are more numerous in the blood of the young and vigorous‡ than in the blood of the old and infirm;* and they are deficient in the blood of the chlorotic, the scrofulous, the scorbutic, of those who live in malarious districts, and in the blood of persons who are much shut out from the light and the fresh air;† while they are found in increased numbers in the blood of the sanguine-tempered and the well-fed. On the whole, I think we are warranted in believing with John Hunter that "their use would seem to be connected with strength, for the stronger the animal, the more it has of the red globules, and the strength acquired by exercise increases their proportion in the whole body."‡

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* Todd and Bowman's 'Physiology,' vol. i. p. 313, foot note.

† Day's 'Physiological Chemistry,' p. 235.

‡ "My own observations, which however chiefly refer to diseased blood, lead to the conclusion that the blood of young persons contains a larger proportion of solid constituents, and specially of blood corpuscles, than that of older persons." On the whole, the experiments of Denis and Le Canu confirm this view. (Simon's 'Animal Chemistry,' vol. i. pp. 236, 237.)

If strength means energy, then the apathy of the Bengalee is directly connected with the deficiency (as compared with the European) in the red corpuscles of his blood. This established, much of the difference which separates the native from the European is to be attributed directly to the same deficiency. His pastimes are not fox-hunting, cricket, and boating, for these demand energetic action, but they are card-playing, kite-flying, drum-beating, and cymbal-clashing, joining in processions, looking at dancing girls, and other such languid exercises. He is not given to boxing, but he is litigious. It is said that he tells many lies, but to tell the truth is often directly troublesome. He is reported to be ungrateful; what, then, is not gratitude an active virtue? He is less brave than an European; but bravery in most is a negative quality, and is strongest in him who, by the aid of energy in his ambition, his sense of duty, his love of praise, his fear of dishonour, etc., can in the most energetic manner overcome the fear of death. He is an inventor and discoverer only in so far as he is driven to be so by his urgent necessities. And his love of tranquil ease has wholly unfitted him to be a navigator on the high seas and an explorer of unknown regions. In fine, it would appear that the difference between him and an inhabitant of Europe is in degree, and not in kind.

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* Simon's 'Animal Chemistry,' vol. i. p. 236.

† Williams's 'Principles of Medicine,' pp. 145, 146.

‡ Palmer's edition of John Hunter's Works, vol. iii. p. 69.

### *Differences depending on Sex.*[*]

The honour of first having pointed out some of the minute structural differences which occur in the sexes belongs to M. Le Canu. The discovery was made by him about 34 or 35 years ago, and it is strange that the attention which it has hitherto attracted from physiologists is in no way commensurate with the deductions which are obviously to be drawn from it. Professor Müller, indeed, has said that he had opened up a new channel in physiological research; but, with this exception, I cannot discover that his most important contribution to science has had its merits even faintly acknowledged.

The following table[†] shows the mean constitution of the blood of both sexes, according to the investigations of Becquerel and Rodier, who, following M. Le Canu, have investigated the matter more thoroughly than he did:—

| | Male. | Female. |
|---|---|---|
| Water . . . . . . . . . | 779·00 | 791·10 |
| Fibrin . . . . . . . . . | 2·20 | 2·20 |
| Solids of the serum[‡] . . . | 77·80 | 79·52 |
| Corpuscles . . . . . . . | 141·10 | 127·20 |
| | 1,000·10 | 1,000·02 |

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[*] See Day's 'Physiological Chemistry,' pp. 234, 235.

[†] See Miller's 'Elements of Chemistry,' part iii. p. 790.

[‡] In this I include fats, salts, and extractive matter. I do so, that this table may be uniform with the foregoing tables, although I am quite aware that to do so is not according to fact; for instance, the blood corpuscles contain a certain proportion of the salts.

The skins of women are softer, and oppose less resistance to violence than the skins of men. Their muscles are also paler, more easily torn, and of less specific gravity. These differences are, in some measure, to be attributed to differences in their daily occupations. Generally, the occupations of men are those which increase the red corpuscles of the blood, and so heighten the colour of the muscles; while, generally, the occupations of women being of a sedentary nature, and carried on indoors, have a tendency to produce opposite results. Still, occupations cannot explain these differences altogether; for a male child, from the time when he begins to crawl, begins to occupy himself differently from what a female child of the same age does. The one is mischievous, and is spoken of as boyish; the other, more gentle in her behaviour, is spoken of as girlish. External circumstances may narrow or extend sexual differences, but they never can wipe them out. I allude, of course, to the blood of men and women of the same nation and country, for I believe that it will in time be shown that the blood of the men of some nations is more similar in its constitution to the blood of the women of another nation, than it is to the blood of the men of the same nation; or, in other words, science will in time enable the men of a certain nation to say to the men of another nation, "Your blood resembles in its constitution the blood of our women, and you are the victims of all the consequences of the condition."

## *Temperament Differences.*

The honour of discovering that the blood of men differs according to the temperament also belongs to M. Le Canu. The following table, *extracted from Simon's 'Animal Chemistry' (Old Syd. Soc. ed.), vol. i. p. 236, presents the results of his experiments made with reference to this question:—

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* Simon's 'Animal Chemistry,' vol. i. p. 236.

1000 parts of blood contained on an average—*

| | Men of Sanguineous temperament. | Men of Lymphatic temperament. |
|---|---|---|
| Water . . . . . . . . . | 786·584 | 800·566 |
| Albumen . . . . . . . | 65·850 | 71·781 |
| Blood corpuscles . . . . | 136·497 | 116·667 |
| | Women of Sanguineous temperament. | Women of Lymphatic temperament. |
| Water . . . . . . . . | 793·007 | 803·710 |
| Albumen . . . . . . . | 71·264 | 68·660 |
| Blood corpuscles . . . . | 126·174 | 117·300 |

### *Differences dependent on Age.*

The relative proportion of the corpuscles and solid constituents of the blood is much greater in the fœtus and in the very young infant than in the adult. Dr. J. Franz Simon says:† "When the skin of the new-born animal loses its red tint the blood becomes more watery, the blood corpuscles and the quantity of iron are diminished, and it becomes relatively, but not absolutely, poorer, for its quantity at the same time increases. Subsequently, however, when the generative powers begin to be developed, the corpuscles and the iron increase, and the relative proportion of water diminishes. At the period of full development, the excess of corpuscles and iron serves in maintaining the necessary energy of this part of the system,‡ and till the generative

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[*] Simon's 'Animal Chemistry,' vol. i. p. 236.

[†] *Op. cit.*, vol. i. p. 238. Compare with Day's 'Physiological Chemistry,' p. 235.

[‡] If they maintain the necessary energy of this part of the system, then, probably, they also maintain that energy which is necessary in providing for the results of the exercise of the same part of the system. It is natural to provide for children, as well as to beget them.

powers begin to flag, the blood remains abundant in solid constituents, and more especially in corpuscles. The skin is softer and more elastic, as are also the various cartilages, in youth than in old age; and, again, the temperature of old bodies is also less on the average than is the temperature of young bodies—less, I believe, by nearly one degree.* Dr. Davy states that the blood of the lamb yields a softer and more abundant coagulum than the blood of the full-grown sheep; and Professor Müller says he has verified Fourcroy's statement that the coagulum of fœtal blood is softer than that of the blood of the adult animal. Mayo and Bostock say that the muscles of the young possess a smaller proportion of nitrogen than is possessed by the muscles of the perfect adult; and Mr. Mayo further affirms that young muscles contain more gelatine but less albumen than old muscles do. Kölliker found that in extreme old age the muscular fasciculi are small, presenting occasionally a diameter of not more than 0·004 to 0·008, easily broken up, mostly without transverse stripes, and with the fibrils very indistinct.† John Hunter instituted a few experiments to decide whether the blood of an old person or of a young person becomes the soonest putrid. He says, "On June 24th, some blood was taken from a woman twenty years of age, and its surface, after coagulation, was covered with an inflammatory crust. On the same day, some blood was taken from a woman aged sixty, the crassamentum of which was also covered with an inflammatory crust. These quantities of blood were set by. The blood from the old woman putrified in two days; that from the young woman kept quite sweet till the fifth day, when it began to smell disagreeably; in this state it continued two days more, and then emitted the common odour of putrid blood." The observer adds, "Several experiments were made in the course of the summer, of a similar nature with the last, in all which it appeared that the blood from young people kept longer sweet than that which was taken from the old."*

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* Davy's 'Physical and Anatomical Researches,' vol. i. p. 174.

† See also Bostock's 'Physiology,' 4th edit. pp. 821, 822. Bostock also says, relying on the experiments of Desmoulins, which, however, appear to be contradicted by those of Von Bibra, that the bones in old age contain more phosphate of lime than the bones of the young, and that old brains are firmer than adult brains.

"The brain in the embryo and in the young child contains more water than the brain in adult life; and in old age the quantity of water seems to be slightly augmented." †

## AGENCIES THROUGH WHICH OUR BODILY TISSUES ARE CHANGED.

Placed on this middle stand-point of the matter of our bodies, then we have, on the one hand, men's behaviour as it is variedly expressed in history (as it has hitherto been written), in systems of religion and philosophy, in sciences and arts (so called), in manners and customs, and in laws; and, on the other hand, those agencies of change which, acting on our tissues, directly and through inheritance, produce in them those changes and differences from which originate those differences in our behaviour that have for so long a time engaged the attention of thinking men,—differences which caused China to stop short in her journey towards perfect civilization, and which have enabled Europe to overtake and pass her on the march; differences which enabled the Greeks to triumph over the Persians, and which forced them in turn to succumb to the Romans; differences which induced a true religion to flourish in England, and a bastard religion in Abyssinia; differences which have given distinctive features to the progress of civil and religious liberty in different countries in all times; differences, in fine, which, when thoroughly known, will explain that intricate play of life around us which in our ignorance we are too ready to speak of as a mystery. In this inquiry, it appears to me that we have hitherto been, and are now, much distracted and trammelled by the custom which most of us have fallen into, of considering man as something superadded to, and not as a part of nature, as something on the web, but not woven into it. We say, when he congregates in towns, that he is living artificially. We speak of his sculpture, his literature, his paintings, his stately buildings, etc., as works of art. We walk into our great industrial exhibitions and exclaim, "See the triumph of our arts!" Then we have our arts of war and our arts of peace, our useful arts and our ornamental arts, and so on, till the list has now become a very big one. Now this manner of speaking would not be objectionable, did we consider the word 'artificial' as expressing, let us say, something pertaining to the finer and more subtle operations of nature; but we do not so consider it, and thus the word 'artificial' has come to convey to the minds of most of us a meaning diametrically different to that which we derive from the word 'natural.' Men congregate and build towns; well, what do the beavers and the ants? They weave cloth, so do the spiders. They construct with mathematical precision; the bees do no less. They build ships, and sail them on the seas, but squirrels have been known to launch themselves from river banks on pieces of bark, and spread their tails to the wind. They sing, so do the canaries. They dance, so the bears and monkeys. Try as we may to cut ourselves off from the general body of nature, we never shall succeed, for there is nothing in our splendid achievements which has not its rudiment* in the humbler divisions of life. At first sight it might appear wonderful that our conception of art, in contradistinction to nature, should have reached among us its present force and extent, did we not remember what a vain and conceited animal man is.* Vain! Is it not much pleasanter to us to be told that the sun, the moon, and the stars were made expressly to give us life and heat, and that the globe and all that pertains to it were made only for our delectation and use, than to be reminded that we come into the world in the same manner as the beasts of the field come; that we eat, and digest, and void, and make blood, just as the beasts do; that if we breathe air and sleep, so do they; that we and they copulate and breed exactly alike; that the same diseases afflict, and the same medicines heal us both; and, finally, that we both die, and are buried, or are eaten, and so return to dust much in the same fashion? We may argue as we may according to our abilities and our educations, but we shall never, by our arguments, be able to silence that wholesome truth which tells us that the products of our arts are in the same way the fruits of that combination of forces (so far as this life is concerned), named man, as pears and apples are the fruits of the trees on which they grow.

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* Palmer's edition of John Hunter's Works, vol. iii. pp. 132, 133.

† Day's 'Physiological Chemistry,' p. 412.

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* I think this was first clearly and unhesitatingly expressed by Agassiz, in his 'Essay on Classification.'

Man is not independent of and distinct from, but a portion of the great scheme of nature; and if life may be likened to a chemical process, then man may be likened to one of the ingredients whose actions constitute that process. He is a varying atom among the general crowd of varying atoms acting on and being acted on. Everything has the power to move about, change him in some degree, just as he has the power to move and change everything besides himself in a like or a greater degree; he is the chief actor in a great play, still he is only an actor, and not a looker on.

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* A little variety, it appears to me, lies at the root of the opposition hitherto accorded to the doctrines of Lamarck and Darwin, for there is nothing blasphemous in considering that man has been created through a long series of inferior organizations, although the belief is very galling to that high esteem in which we hold ourselves.

I will arrange the agencies by which the tissues of men's bodies are changed under the heads :—

Use.
Social Condition.
Climate.
Mixed Parental Influence.
Hereditary Transmission.

### USE.

Mr. Paget,* in his 'Lectures on Surgical Pathology,' says, "Whenever muscles lie long inactive, they either waste or degenerate; and this, whether the inactivity depend on paralysis, through affection of the nervous centres or fibres, or fixity of the parts they should move, or on any other cause." The degeneration which Mr. Paget here speaks of, he explains in other passages of the same book. It essentially consists of a wasting of the proper muscular tissue, and of a transformation of the same tissue into a kind of fat, and what is true of the muscular tissues is no less true of the nervous tissues. "Of the atrophy following diminished or abrogated functions of nervous parts, I have already mentioned examples in the shrinking of the brain, in the wasting of the nerves of paralysed or fixed muscles, and in that of the optic nerve and tract in cases of blindness.† In the atrophies of the brain or spinal cord, whether from obstructed circulation or hindered function, the chief changes that are observed are the liquefaction or softening of the whole substance, the breaking up of the nerve fibres, and the production of a number of granule cells or masses, and free floating granules."* Dr. Bucknill,† among the causes of atrophy of the brain among the insane, does not include hindered function or enforced rest as one of them; but we may be assured that disuse plays an important part in bringing about the condition. Concuss the brain so as to unfit it for mental manifestations, and atrophy ensues; and in this process the order of events appears to be, enforced rest, imperfect nutrition, atrophy,—just as in the wasting of the optic nerve and tract consequent on blindness, the order of events appears to be, enforced rest, imperfect nutrition, atrophy. In physiology nothing has been more clearly made out than this, that moderate exercise improves, and disuse degrades the tissues of our bodies, let them be situated in the brain, the kidneys, the liver, or in any other organ.‡ Let us daily exercise our muscles, and in time muscular exertion becomes easy and pleasant to us. Let us continue to dream away our time on soft beds and luxurious couches, and shortly muscular exertion is neither easy nor pleasant. So with the brain-tissues; thought by frequent practice becomes easy, and in time the regularly thoughtful man is able to deal with subjects which before he became regularly thoughtful were to him almost unintelligible, with the same ease and power as is displayed by him who is regularly used to cricket when he begins to handle a cricket-ball.§

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* 'Lectures on Surgical Pathology,' p. 91.

† *Op. cit.*, p. 110.

Certain combinations of circumstances call into play certain groups of our organs more frequently and in greater force than they call into play other groups. The consequence of this is that when we are subjected continuously for a length of time to the operation of certain combinations of external agents, the groups of organs most strongly excited by these will in time, through the improvement in their tissues brought about by exercise, predominate in our constitution, and stamp us with their characteristics. In this way it is that the bodies of men wear different expressions;* and that, for instance, a countryman, a resident in town, or a seaman can be distinguished in a crowd. Changes in language are to be explained to a certain extent in the same way. Further, it is in this way that the bodies of men come to wear habitually an expression of sorrow, or joy, or discontent, etc., as also how certain occupations change the members of a family originally very much alike. Without opening their mouths one is quite the tailor, a second is quite the clergyman, and a third quite the astute merchant. These principles may also be used to explain, in some degree, the differences which we observe in the manners, tastes, habits of thought, etc., in different nations.

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* Paget's 'Lectures on Surgical Pathology,' p. 111.

† 'Psychological Medicine,' Bucknill and Tuke, pp. 421, 426.

‡ See Phys. Anat. and Pathol. Researches by John Reid, pp. 10, 11.

§ Mr. Gibbon describes with how much more ease he latterly composed than when he began his history. See his memoir by M. Guizot, prefixed to Bohn's edition of his works.

Education in its widest sense is the regular and moderate exercise of all our organs, in its narrower sense it means the discipline which we undergo, and the knowledge which we acquire at school. Its object is twofold, first to improve and harmonize our natural parts by means of exercise and repression (*i.e.* hindered function); and second, the acquisition of knowledge. The former is the more important, perhaps, and the most difficult to attain. Organs vary so much in their quality and in their positive and relative extents in different children as to render it impossible in these comparatively but little advanced times to frame and adopt a perfect system of school education. The one in use, if it is not perfect, is at least tolerably safe, its highest merit being that it supplies us with the means of acquiring further and higher kinds of knowledge than what we acquired at school.*

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* See Mayo's 'Physiology,' 4th edition, p. 456.

Knowledge.—What effect does the acquisition of knowledge produce on the tissues of our bodies? The exercise of acquisition improves the quality, and (guided by the behaviour of the optic tract and nerve after the destruction of vision) we may venture to say it increases the quantity of our brain tissues, thereby fitting them for a readier and more effective use in whatever direction and on whatever labour they may hereafter be employed; and by aid of the memory, or that property of the brain tissues which we speak of as memory, it accumulates a store which gives an immense advantage in the struggle for life and position to him who possesses it over others more ignorant, whose natural capacities are only equal to or inferior to his own. Knowledge does not constitute a faculty, but it is a powerful machinery, which, when placed at the disposal of faculties capable of using it greatly adds to their original power. By its assistance we scatter prejudices and superstitions, we limit the fantastic tricks of tyrannical and pretentious men, we shorten distances and economize time, we elevate the matter of our bodies through protecting them against the wear and friction of things external to them,† we supply wholesome exercise for our nobler faculties or organs, we clear up, in a certain degree, the so-called mysteries of our being, and we furnish ourselves with irresistible reasons for devout and humble adoration of Him who made us and upholds us. Knowledge, full and unreserved, and the capacity to use and increase it, together form the greatest earthly blessing which can be bestowed on man. Let us all be thankful that we live in a comparatively scientific age—in an age, when, without any risk to our personal integrity at least, we can boldly speak what we think, and listen to the enunciations of what others think.

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* In their examination by the School Commission, both Faraday and R. Owen advocated the teaching of Physical Science in our public schools, but they differed much in their opinion as to the extent to which it should be taught; the former allowing it an important place, the latter an unimportant.

† Through the aid of the same, Louisiana ultimately came to be colonized, and is now inhabited by white men of great gallantry. For an account of the hardships which the early settlers had to undergo, and the adverse circumstances with which they had to contend, see Bancroft's 'History of America,' Routledge's edition, vol. ii. pp. 844–5. The difficulties overcome there were as great as those which proved fatal to the Scotch in their great expedition to Central America (see last volume of Macaulay's 'History of England'), and the early his-

Habit.—When we have exercised any one or any group of our organs so continuously as to render its exercise, as compared with the exercise of other organs, more easy and pleasant, and the organ or group of organs more powerful in its action, then we have formed or acquired a habit. A habit, therefore, means improvement and increase of certain tissues through the agency of use.*

Custom is in its nature negative rather than positive.† Sometimes we say we have only in so-and-so matter followed the custom ; and at other times, when the occasion requires it, we may say that we have become accustomed to such-and-such a thing. Now, adopting or following a custom, and becoming accustomed to, are not convertible processes. In the former, without effort on our part, we follow, or swim in a stream which has been set in motion by forces external to us, and the act of following may have no further effect on our tissues than results from the mere effort of following.

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tory of the State warrants the belief that Bengal will ultimately be colonized by Europeans when the pressure of emigration becomes sufficiently great.

* Compare with Palmer's edition John of Hunter's Works, vol. i. pp. 274, 276.

† 'Dublin University Magazine,' no. lxviii. pp. 668–675, as quoted by Prichard in his 'Physical History of Man,' vol. ii. p. 349, note.

In the latter, however, we are subjected to the action of things external to us, or to actions within us originated by external agents. When these have ceased to impress us, or to impress us in a very limited degree, then we say we have become accustomed to the action of these agents. Now, what does the condition of "accustomed to" imply? I answer, that, without doubt, it implies some change in the material condition of the tissues. This will be most clearly understood by observing the appearances presented by a few ulcers, as they are severally subjected to the actions of different lotions or ointments. A sore which for three days has continued healthy under the application of black wash, on the fourth becomes sluggish in its action, and ceases to progress; blue wash being substituted, it resumes a healthy action for three days more, when under the continued application of the same, it again becomes sluggish; when, if black wash be re-applied, the probability is that it (the sore) will become healthy as before, again, however, to resume unhealthy action if this agent be too long applied, which action in turn will be cured by a second recourse to the blue wash. Here there is an alternation of conditions which visibly shows what is meant by custom. The wounded tissue, unaccustomed to the impressions which black wash can make on it, responds to its action, and becomes healthy; by-and-by, however, another unhealthy change takes place in the tissue, which fortifies it against the continued action of the same agent. That the unhealthy condition present when the black wash was first applied, and that when it was left off, are not the same, is proved by the difference in the influence which this agent exerts on both. Here, then, is a plain demonstration of the states 'unaccustomed to' and 'accustomed to.' "Unaccustomed" is shown by the granules of the sore becoming hæmorrhagic and sharply granular, like the roe of a herring under the application of a certain substance; while "accustomed to" is shown by the pale, bloodless, flabby granules which arise in the same sore in spite of the continued application to it of the same substance. In this way we become accustomed more or less to almost everything which has the power to impress us; and mountain scenery, the roar of the angry ocean, the majesty of a mighty waterfall, etc., after a time fail to make that vivid impression on us which they did at first; even misery in time becomes endurable. There are certain impressions to which the tissues never become accustomed, and if we continue to submit them to the action of the agents producing these impressions, then disorganization and death will result. Doubtless, many of the changes in the tissues brought about by change of climate and social condition, are of the same nature as those induced by custom. Habit, then, refers to the action of, and to changes induced through the action of, a whole organ where a faculty or function resides, while custom treats of the changes in the minute structure of matter, and directly has nothing to do with that complex action which we speak of as function.

## SOCIAL CONDITION.

"Our social condition," in its widest sense, means that condition which is the result of the struggle made by our progenitors and ourselves for life and superiority with things external to us. This, of course, embraces the whole subject of this paper. Under this head, therefore, I will confine myself to a consideration of the main effects on the tissues produced by those combinations of circumstances which we speak of as adversity and prosperity. When we are prosperous, we have at our command the means of protecting ourselves against the excessive and injurious operations of things external to us. When we are not prosperous, then we have not the means of so protecting ourselves. The following case illustrates the operation of adversity in the sense in which I use the word:—"On the plantation of Ulster, and afterwards on the successes of the British against the rebels of 1641 and 1689, great multitudes of the native Irish were driven from Armagh and the south of Down into the mountainous tract extending from the Barony of Flews eastward to the sea; on the other side of the kingdom, the same race were expelled into Leitrim, Sligo, and Mayo. Here they have been almost ever since exposed to the worst effects of hunger and ignorance (disuse), the two great brutalizers of the human race." The descendants of these exiles are now distinguished physically from their kindred in Meath and other districts, where they are not in a state of physical degradation. "They are remarkable for open, projecting mouths, with prominent teeth and exposed gums; their advancing cheek-bones and depressed noses bear barbarism on their very front. In Sligo and northern Mayo, the consequences of two centuries of degradation and hardship exhibit themselves in the whole physical condition, affecting not only the features but the frame, and giving such an example of human deterioration from known causes as almost compensates, by its value to future ages, for the suffering and debasement which past generations have endured in perfecting its appalling lesson. Five feet two inches on an average, pot-bellied, bow-legged, abortively featured, their clothing a wisp of rags, etc.,—these spectacles of a people that once were well-grown, able-bodied, and comely, stalk abroad into the daylight of civilization, the annual apparitions of Irish ugliness and Irish want. In the other parts of the island, where the population has never undergone the influence of the same causes of physical degradation, it is well known that the same race furnishes the most perfect specimens of human beauty and vigour, both mentally and bodily."

Now, this is a passage which ought not to be read over by us as if it were an old ballad. As the author says, the lesson which it teaches compensates by its value to the world at large for the misery which the experiment has caused to those who have been experimented on. It is an experiment parallel in most of its features to Magendie's experiments on geese and dogs, but infinitely more trustworthy than these, inasmuch as it has been tried upon a numerous people through a long succession of generations. Hitherto the deductions which it warrants have not been turned to much account by us, for they jostle our prejudices and overthrow our metaphysical dogmas; still they do not the less clearly show that good food and protection against the weather are as necessary for the existence of moral and intellectual excellence, as moral and intellectual teaching are; nay, more, that in the scale of importance, the former takes precedence of the latter.

The history and present condition of the bushmen afford another remarkable instance of physical degeneration following on exposure to adversity. These people are a branch of the Hottentot people, and in more prosperous times lived on the produce of their flocks and herds. But having been overcome by their more powerful or fortunate neighbours, they are now the degenerate and brutish people which writers have represented them to be. "Without houses or even huts, living in caves and holes in the earth, these naked and half-starved savages wander through forests in small companies or separate families, hardly supporting their comfortless existence by collecting wild roots, by a toilsome search for the eggs of ants, and by devouring, whenever they can catch them, lizards, snakes, and the most loathsome insects.*" "A peine peuvent-ils former raisonnement,

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* This degeneration has received an undeniable illustration in the case of the Koranees, a tribe of Hottentots who were, at a compa-

et leur langage, aussi stérile que leurs idées, se réduit à une sorte de gloussement qui n'a presque plus rien de semblable à notre voix. D'une malpropreté révoltante qui les rend infects, toujours frottés de suif ou arrosés de leur propre urine, se faisant des ornemens de boyaux d'animaux qu'ils laissent se dessécher en bracelets ou en bandelettes sur leurs peaux huileux, se remplissant les cheveux de graisse et de terre, vêtus de peaux de bête sans préparation, se nourrissant de racines sauvages ou de pances d'animaux et d'entrailles qu'ils ne lavent même pas, passant leur vie assoupis ou accroupis et fumant, parfois ils errent avec quelques troupeaux qui leur fournissent du lait. Isolés, taciturnes, fugitifs, se retirant dans les cavernes ou dans les bois, à peine font-ils usage du feu si ce n'est pour allumer leurs pipes, qu'ils ne quittent point. Le foyer domestique leur est à peu près inconnu, et ils ne bâtissent pas de villages, ainsi que les Caffres leurs voisins, qui regardent ces misérables comme une sorte de gibier, leur donnent la chasse et exterminent tous ceux qu'ils rencontrent."*

The following remarks by a master in his department,† show the beneficial action of prosperity on a class of people who in their own persons, and in the persons of their progenitors, had for a long sime been subjected to the influence of adversity. The subject is Cretinism, and the speaker is Dr. B. A. Morel. He says, "We seek to separate those who are attacked or threatened from the infected locality; we place them in elevated districts, where they breathe

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ratively recent date, driven out into the wilderness. When visited by Mr. Thomson on the Hartebeest river, he found that they had adopted the habits of the bushmen, and had become assimilated in every essential particular to that miserable tribe. (See Prichard, 'Physical History of Man,' vol. ii. p. 180.)

* See 'Dictionnaire,' classe d'Histoire Naturelle, art. "Homme," quoted by Prichard, *op. cit.* vol. ii. pp. 178–180.

† 'Journal of Psychological Medicine' for April, 1857, p. 205.

purer air; we modify the nature of the water by adding iodine in some form; we seek to fortify the enfeebled constitution; we administer tonics and strengthening baths; we act upon the nervous system by means of electricity; we employ gymnastics; we try by every means to awaken the senses; we have the greatest confidence in the influence of the moral on the physical nature; we make energetic appeals to what remains of emotion and intelligence, to arrest the march of the evil, and to prevent complete degeneration. This is not an empty theory, but one the effects of which have been proved in successful practice. But we attack also the evil in its origin and source; we render the localities wholesome by embanking rivers, and converting stagnant pools into running water. By these and such measures Cretinism has been extirpated at Robertsan, near Strasbourg and other localities." "Cretinism extirpated!" Unless we pause to ruminate over the meaning of these words, we are apt to miss its full force. Cretinism extirpated at Roberttan; that means a community of men, women, and children have, in their own persons, or in the persons of their descendants, been transformed from mere idiots,—or, in other words, creatures of irregular and often vicious passions, and of less intellectual capacity than belongs to horses and dogs, who are incapable of contributing towards their own wants, or the wants of society, who have forgotten the past, and are incapable of speculating on the future,—into beings who may be good relatives, good friends, and good subjects; who take an interest in what is going on around them, and who anticipate immortality. And how is this transformation wrought out? Not through the instrumentality of moral and philosophical teaching, but by placing at the disposal of the victims the ordinary means to health, viz. good food, appropriate clothing, suitable exercise, and a wholesome residence. Here is a theme over which metaphysicians and moral philosophers may ponder and be sad.

When we come to analyse the condition of prosperity, we find that it is *essentially* constituted of the means to health above enumerated, viz. good food, appropriate protection against the weather, suitable exercise, and a wholesome residence; adversity in its various grades being the absence of these in different degrees. Good food means articles of food of good quality, mixed in those proportions which have been found the best adapted for the maintenance of the tissues in a state of perfect health. It will always be composed of animal substances, vegetables, grains, and stimulants, such as alcohol, tea, pepper, and tobacco. Every one knows the influence which good food exercises over the tissues of the lower animals. If we feed our dogs and horses liberally they grow fat, if we give them little to eat they grow thin; but that food exercises the same kind of influence over the bodies of men has not yet been fully recognised, notwithstanding that in Hindoostan a man's bodily condition is taken as the true index to his social condition. Is he lean? then he is regarded by his neighbours as poor; is he fat? then his neighbours speak of him as being prosperous. And a little observation will convince any one who has lived a little while in India that the sign is a safe one to guide us in our judgments on the matter. How a difference in food should produce a difference in the minute structure of tissues, will easily be understood by us when we recall our experience of the meats which we have eaten. Thus grain-fed mutton differs from grass-fed mutton, and turnip-fed mutton is different to both. So with beef, butchers and their customers can tell at once what cattle have been fattened only on straw and turnips, and what cattle have, in addition, eaten linseed cake. Then wild pig is not the same in its flesh as tame pig, wild pigeons as tame pigeons, hill sheep as sheep of the cultivated districts, wild deer as park deer, and so on.*

Suitable exercise in its wide and proper sense, means the moderate use of all our organs as I have endeavoured to show in my section on use, and I only reintroduce the subject here to show that the poor are too often obliged by the necessities of their position to exercise some groups of their organs too much and other groups too little. For instance, labourers expend too much of their energy in the exercise of certain muscles, and poor clerks in the exercise of certain portions of their brains. When the daily appointed tasks of both are finished they have not sufficient surplus energy left, by the aid of which they may exercise those other organs whose exercise is not required in the discharge of their duties; and this is one instance where occupation honestly attended to, may, unconsciously to ourselves, destroy the symmetry of our characters. Every one without effort can supply himself with many similar instances.

"Comfortable clothing and lodging" is a term the meaning of which is well understood by the inhabitants of cold countries. When our desires are satisfied, and the impressions which are being made on us by things around us are in conformity with the requirements of the then condition of our tissues, we feel comfortable; when the contrary is the case we feel uncomfortable. That which makes us comfortable at one time may make us uncomfortable at another time, according to the condition of our tissues when it impresses them. Are we well? then the breezy uplands are pleasant to us. Have we fever in our body? then we prefer to cower over the fire, or to shiver under the blankets, and the breezes and changing sunlight and the living landscape impress us unpleasantly.

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* The same influence of food is visible in the cultivation of plants. Indeed, within very wide limits, success in gardening depends on knowledge as to how plants should be fed and managed. Mr. Lawrence ('Lectures on Physiology and Zoology,' 3rd edition, p. 432) says, with reference to the whitening of plants, "Nor is the effect merely superficial; it extends to the texture of the plant, to the taste and other properties of its juices." When he wrote this he ought, I think, not to have concluded that climate is insufficient to produce differences which distinguish races.

Comfortable clothing will vary in its amount according to the capacity of the body which wears it to resist cold. This will differ in different individuals, and in the same individual at different times.

A lodging will be thought comfortable or uncomfortable in an essential respect according to the past experience of him who judges. A labourer who has hitherto resided in a clean and comfortable cottage would feel uncomfortable were he to be lodged in the sumptuous palace of a king; as the king would do were he to reside in the clean and appropriately furnished cottage of the labourer. But in times of emergency all men are pretty well agreed as to the essential elements of comfort in a lodging. These are, if I mistake not, a place fenced in from the open air, an agreeable temperature, the use of a pleasant light and the means to refreshing rest. When these are supplied to us in greater proportions than is necessary for the welfare of our tissues, then we live in luxury; when in less proportion, then we endure hardship. Of the deficiencies which constitute hardship, I will here merely consider the deficiency in an agreeable temperature, and this only in so far as it refers to cold. I do so not because I think the effects of cold are the same as those of heat, but because I consider them to be very similar, and because in this paper I am compelled to sketch rather than exhaust. Fencing in from the open air, and the means to refreshing rest, being comparatively unimportant, do not merit special notice here. A sufficiency of pleasant light is of more importance to our bodies, but I will not specially consider it, as it is so closely allied in its nature and effects to temperature.

TEMPERATURE.—The effects of temperature are not to be measured altogether by the thermometer, for we know that the same temperature has very different consequences in different localities, solids and vapours modifying its action in very considerable degrees.* The remarks which I offer here refer to the action of cold applied in different measures in the same locality; as, for instance, the different results which might ensue to the tissues of the same person while living in the same house when it should be applied in different degrees of intensity. John Hunter says, that in the actions of different animal tissues the amount of heat required is in the following order:—propagation, digestion, sensation, including wakefulness, secretion, circulation. "Propagation requires the greatest, digestion may be carried on with a degree less, secretion in two degrees less than propagation, and so on."† The observations and experiments of other physiologists support Mr. Hunter's statements. The healthy human body may perform its functions in such a way as to maintain health in a temperature much lower than its own normal temperature, a low temperature intermittently applied often being a stimulus to health, but that it should be able to do so, it is necessary to protect it against the influence of excessive cold at certain times—at times when it (the body) is in a state of repose, or in a state of absolute rest, such as that of sleep. Now, poor people, at least the poor of England, have not the means of protecting their bodies sufficiently against the influence of cold at these times. The walls of their houses are thin, or they are not weather-tight, and their bodies are covered with rags or insufficient clothing, and they have not money to purchase sufficient coal, the burning of which produces external heat, or a sufficiency of proper food, the digestion and assimilation of which produces internal heat. What is the consequence?—necessarily, degeneration of the tissues of their bodies. I believe that the continued influence of a low temperature is one of the most degrading influences with which the poor of England have to contend. It interferes with the effective propagation of their species,* and with the effective discharge of the functions of secretion, digestion, sensation, and circulation. To those who contradict this statement, I wish to point out that life, whether it be human, lower animal, or vegetable, is more luxuriant in temperate climates than it is in extremely cold climates; that continued subjection to a certain degree of cold kills the young of both animals and vegetables, and to a greater degree the parents of these as well; that eggs cannot be hatched, or food digested outside of the body (*i. e.* artificially) without a certain amount of warmth; that certain animals, when under its influence, become torpid, and neither eat nor feel, and grow lean; and that sudden changes of temperature are the cause of a large proportion of the diseases which yet have received a name.

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* On this subject, see more especially Chapter X. of Tyndall's 'Lectures on Heat considered as a Mode of Motion.'

† Palmer's edition of John Hunter's Works, vol. i. p. 285.

There are other agents which, although not so essential to the well-being of our tissues as those named, are still not wholly unnecessary to the completion of home comfort. Among these are objects on which we may lavish our domestic affections, the intricate play of persons whom we like and respect as they mix together in the different manners allowed by society, the view of a landscape more or less varied with wood, water, and cultivated fields, and a country whose surface rises and falls, gardens, music, pictures, books, elegant dress, elegant furniture, elegant equipage, and so on. These all in their various degrees impress us, especially if they are new to us, and through the impressions which they make on us they change in some measure the tissues of our bodies. But as it is impossible in a skeleton paper like this to discuss these agents of change in detail, I here allude to them only that I may name them.

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* Any one who has examined the children of ragged schools can understand this.

WHOLESOME LOCALITY TO RESIDE IN.—The man who possesses this, possesses a spot where he can breathe air of a purity sufficient for the wants of his body, where he can easily obtain a sufficiency of fresh and uncontaminated water, and, above all, where he is not too much exposed to the action of certain unknown forces. The benefits which pure air and a plentiful supply of good water confer on us are now very well known; but let me explain what I mean by the phrase "exposure to the action of certain unknown forces." Dr. Parkin, in his lucid and logical work* tells us that in Port of Spain, Trinidad, which is hemmed in on each side by a swamp, the residents, and even strangers, enjoy a comparative immunity from fever; but that if the same persons "take up their abode for a single night on the La Vantillo hill, in the immediate neighbourhood, overlooking the magnificent Bay of Trinidad, large enough to sustain all the fleets in the world," they will certainly suffer from fever in its severest form. Indeed, so deadly is the spot, that not even a Creole Spaniard can sleep here for a single night with impunity. In India, now, when cholera shows itself in a regiment of European soldiers, these are at once marched into camp at some distance from the place where they resided when the disease first manifested itself, and the camp is usually shifted every day or two, while fresh cases occur, to a distance varying from five to ten miles. This measure, a very simple one, has hitherto been found the surest protection against the ravages of this dreadful disease. We know that at home certain diseases, for instance, small-pox and typhus fever, prevail with greater virulence among the populations of certain localities than among the populations of other localities, although the people compared are apparently the same in social condition; and that a person from the unaffected locality, while residing in the affected locality, will probably also be attacked by the disease prevailing. Now, these three instances, selected from many others, make it plain to me, that at times, in certain localities, certain forces become so intense in their action as to overcome the means of protection which we possess against them, and to produce in the bodies of persons sufficiently exposed to their operation, certain morbid conditions which, according to their leading features, we name small-pox, cholera, fever, dysentery, etc. When these forces act in this degree, then the locality where they so act is an unwholesome residence; when they operate in a less degree, then the locality where they so operate is a wholesome residence; that is, of course, in the sense in which I use the words. It is very difficult, and perhaps impossible, to adduce an instance where changes in our bodily tissues, that have not resulted in immediate death, have been brought about solely by the operation of those agents which render a locality unwholesome as a residence. It is difficult, because the action of these is so frequently combined with the action of other agents, such as of exercise, food, temperature, etc.; but I will adduce the following as one where the action of the former, at least, played a very conspicuous part in bringing on the conditions described. The instance is that of the inhabitants of La Brasse, and the words descriptive of their condition are those of a writer in W. Winslow's Journal, who borrows from Montfalcon and Morel. He says,* "The Bressans, disinherited by nature, only feel the burden of life; the mournful influence of their climate is impressed upon their features; it modifies to an extraordinary extent their functions and their faculties. They are born sickly, and they cease to live at what should be the age of vigour. All the elements conspire to the ruin of the Bressan. The air he breathes, the water he drinks, are both poisoned; his miserable dwelling is scarce a defence from a pernicious atmosphere; and the kind of labour which he pursues amid humid forests and morasses, does not permit him to anticipate a brighter future. His stature is short, his bones rickety, his skin sallow, thin, and unhealthy, his muscles flabby and undeveloped, his features tumid, his belly swelled and dropsical. Scarcely has he quitted the breast when he begins to languish and emaciate; a large proportion die before the age of seven; those who survive do not live, they vegetate. . . . Melancholy apathy, a sort of idiocy, is the habitual expression of a countenance rarely modified by passions. Old age commences at forty-five; they are decrepit at fifty-five; few reach sixty. 'We do not live,' said one of these creatures, 'we do not live, we die.'"

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* 'Causation and Prevention of Disease,' p. 44.

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* 'Journal of Psychological Medicine' for April, 1857, p. 202.

When the agencies constituting adversity affect our bodies in greater force than is necessary to produce the changes in its tissues which I have above hinted at, then the condition of actual disease is engendered. This is very apparent in the so-called malarious districts in seasons of famine, or when the weather is very inclement, when fevers become epidemic, and assume a very fatal type. On the same principle, cold and heat will be beneficial, prejudicial, or fatal; and the same is true of moisture. An exceedingly dry atmosphere, as in the case of the Sahara Desert, or a very moist one, as in the cases of Bengal and Brazil, prove prejudicial or fatal to the tissues of highly organized men. Indeed, it may be stated broadly that everything external to us affects us beneficially or prejudicially according to the condition of our tissues at the time when it affects us, and to the measure in which it is applied. Too little food is in its results scarcely more disastrous than too much food, and the same may be said of all stimulant substances. Then, all the substances named in the Pharmacopœia are medicinal or poisonous, according to the state of our tissues when they are used, and to the measure in which they are used. Even the so-called zymotic poisons are beneficial in protecting us against the causes of certain diseases when applied wisely, as is evidenced by the good effects which have followed vaccination and inoculation. The practice of every medical man affords many illustrations of this doctrine; and perhaps some of the most remarkable of these are witnessed in the course of administering opium and quinine. To some patients these drugs afford instantaneous and complete relief from their sufferings; while at other times their administration to the same patients, when these are suffering from the same diseases, gives increased pain and discomfort. Dr. Dickson in his work* (in some respects admirable) truly says there is no such thing in nature as a specific; nay, that certain of the supposed specifics will, in certain conditions of the body, produce the diseases which they are believed to be infallible in curing. This is certainly true of quinine, and I am not sure that this is not also true of ipecacuanha when considered with reference to dysentery.

## CLIMATE.

Under the head of Social Condition I have shown, or attempted to show, on the one hand, that a certain amount of protection against the friction of things external to us and against the vital processes within our bodies, improves our tissues; and, on the other, that insufficient protection against these agents and processes degrades them. Differences produced by differences in social condition will be studied with the least risk of error among the different classes of the same people situated in the same locality; while differences produced by climate will best be studied by comparing the corresponding classes of sections of the same people separated for centuries in different countries and localities.

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* 'Fallacies of the Faculty.'

Before I proceed further, let me explain what I mean by difference in climate. If we were to take two naked men,* brothers, and in a latitude of [illegible]2°, to place one of them in the steppes of Central Asia, and the other somewhere in the south of England, and to subject both to the influence of the same social conditions, that is to say, to confine them within four walls as nearly similar in both instances as masons could make them, and to feed them with the same food, while in other respects to leave them freely exposed to the influence of things external to them, for the space of one, five, or twenty years, if they continued to live, it would be found that these brothers, when compared at the end of the period of trial, differed in appearance and general behaviour. This difference in results would be the measure of the differences in the climate of the two localities. The complex agency of climate is yet so little known, that most writers describe it differently; and the only way in which we can form an opinion of it, is through its results, as they are manifested in the animal and vegetable worlds of different localities. Dr. Prichard, in his volume on the African races, gives some very striking instances of the influence of climate. Thus he tells us† that the Barabra of the Nile, although descended from the Negro mountaineers of Kordovan, and exempt, as they are said to be, from intermixture with the Arabs and other inhabitants of the Nile valley, have nevertheless acquired, and now display physical characters of a very different description from those of the Negro. A similar change has taken place, under corresponding circumstances, in the character of the Fonge, the conquerors of Sennaar, who, although descended from the Shitukh Negroes, have no longer the *genuine characters* of the Negro race. Again, the same writer says that the Amakosah Kafirs, in their skulls and shape of their faces, resemble the Indo-Atlantic nations; yet it cannot be doubted, from an investigation into their history, that they form a genuine African race. Then Dr. Knox, a considerable authority, asserts that the Kafirs are the improved Negroes of a temperate and mountainous region. "Those races who have the Negro character in an exaggerated degree, and who may be said to approach to deformity in person—the ugliest blacks, with depressed foreheads, flat noses, crooked legs,—are in many instances inhabitants of low countries, often of swampy tracks near the sea-coast, where many of them, as the Papels, have scarcely any other means of subsistence than shell-fish, and the accidental gifts of the sea." In many places similar Negro tribes occupy thick forests in the hollows beneath high chains of mountains, the summits of which are inhabited by Abyssinian or Ethiopian races.* The inhabitants of the Southern States of North America, who are mainly the descendants of the English and Scotch, and Australians even, patently differ in appearance from the inhabitants of the parent island, and the extent of their differences is the measure of the differences in the climates of these countries.† Mr. Lawrence‡ thinks that the complex agency of climate is not of sufficient force to produce the various differences which we see in men. His arguments cover too much ground for me to consider them in detail, so that I must content myself with attacking the key of his position. He say, "In conformity with the views already explained, respecting the mental part of our being, I refer the varieties of moral feelings, and of capacity for knowledge and reflection, to those diversities of cerebral organization which are indicated by, and correspond to the differences in the shape of the skull." In another passage he says, "The quantity of food has great influence on the *bulk* and state of health of the human subject." Now, if the quantity of food, which is an external agent, and whose amount is determined by climate, can increase our *bulk*, why should it not also increase the size of our brain? If external bulk represents internal bulk, or, in other words, large men have large livers, hearts, etc., and food administered in certain quantities having increased the size of these organs, wherein is it incredible that it should also increase the size of the brain? and yet food is only one of many elements which compose that external agent, climate. It see [illegible] consistent and even puerile to admit that food can improve our muscles, and to deny that it can improve our brains, on whose diversities of organization, Mr. Lawrence allows, moral and intellectual differences depend. The same stomach, assimilating apparatus, blood and heart, minister to the wants of both. Again, the writer says,* "Some have found a convenient and ready solution in climate, but have not condescended, either by example or reasoning, to show how climate can operate on the moral feelings and intellect, or that it has actually so operated in any instance." As an answer to this remark, I will adduce the following extract from the writings of that very close thinker, Dr. Prichard:†

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* For the sake of clearness, I will suppose that these in every respect are exactly alike.

† 'Physical History of Man,' vol. ii. chap. xi. sec. ii.

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* Prichard's 'Physical History of Man,' 3rd edition, vol. iii. p. 337.

† On this subject, see also Prichard, *op. cit.* vol. iv. p. 613.

‡ See his 'Lectures on Physiology and Zoology,' chapters viii. ix.

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* 'Lectures on Physiology and Zoology,' 3rd edition, p. 417.

† 'Physical History of Man,' vol. iii. p. 338.

"We may further remark, and perhaps this observation is fully as important as that of any other connected fact or coincidence, that physical qualities of particular races of Africans are evidently related to their *moral* or social condition, and to the degrees of barbarism or civilization under which they exist. The tribes in whose prevalent conformation the Negro type is discernible in an exaggerated degree (these are they who inhabit low countries, swampy tracts near the sea-coast, the hollows of mountains, etc.; see extract above given) are uniformly in the lowest stage of human society; they are either ferocious savages, or stupid, sensual, and indolent; such are the Papels, Bulloms, and other rude hordes on the coast of Western Guinea, and many tribes near the Slave Coast and in the Bight of Benin. . . . On the other hand, wherever we hear of a state the inhabitants of which have attained any considerable degree of improvement in their social condition, we *constantly* find that their physical characters deviate considerably from the strongly marked or exaggerated type of the Negro." "By a minute comparison of the different parts of the land, M. Boné has shown that similarity of outward forms, while indicating similarity in the producing causes, must also to a larger extent indicate identity of structure."* I need scarcely say that I entirely concur with M. Boné in this, or that I believe the differences which we see in men are as much the result of differences in localities as the differences which we see in trees and in the lower animals are. I do not, however, by this assert that the differences which we now see in nations are altogether the result of differences in the localities where they now reside, for due weight must be giv[illegible] mixture of nations, and to immigrations *en masse*. Thus the Huns and Goths who came from the East and peopled Central Europe, are in their descendants a mixed result of contact with the East where they originated, and of the West, where they now reside. The impression made by the natural forces, or that combination of natural forces which prevails in certain localities, can only be obliterated by exposure to the influences of the same forces acting in different combinations, and in a space of time proportioned in its extent to that space of time in the course of which the original impression was made, and to the relative intensity with which the natural forces acted in the localities compared. If we roll a ball, the time which it continues to roll will depend partly on the amount of force communicated to it, and partly on the friction which it has to overcome on the surface over which it rolls. So with men; the Jews of to-day still resemble each other, but they differ, at the same time, in proportion to the difference in the forces with which they have contended since the time when they were driven from Palestine.* The impression communicated to them by a residence in what is called their native country, was deep and lasting, and a long time must elapse before it is entirely obliterated; but that in time it will be obliterated, I have no doubt.

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* Somerville's 'Physical Geography,' 5th edition, p. 36.

Differences in climate may be referred to differences in heat, moisture, chemical action, electricity, magnetism, and light;† and differences in these may be referred to differences in distance from the sun, moon, and stars, from the equator, in the relative distribution of land and water, in the irregularities of the earth's surface, in the composition of the earth's crust, and probably in differences in the relations which exist between different portions of the earth's crust and the interior of the earth, where the elements of volcanic action are supposed to reside. To a difference in the intensity of these conditions, and in the measures in which they are combined in action, are to be attributed the trade-winds and the gulf stream, with their numerous consequences, the milder atmospheres of islands and western shores, the severer skies of continents and eastern shores, the hot winds of Northern Africa, and the influence which it exercises over countries bordering on the Mediterranean Sea, the direction of the great chains of mountains, the depressions and elevations of the earth's surface in all degrees, the difference in the climates of the northern and southern hemispheres, the cold of the Poles and the heat of the equator, clouds, etc.*

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* This point is always overlooked by those who contend for the influence of breeds and stocks. Another element which is usually omitted from the speculations of these philosophers, is that which is always so prominently present in the minds of such men as Lyell, Darwin, Lamarck, and others, viz. Time; and thus we find a man of the abilities of Lawrence, gravely writing "*two centuries* have not assimilated the Anglo-Americans to the Indian aborigines, nor prevented them from establishing in America the first government in the world." (Lectures, p. 417.)

† I speak of these as separate forces, although I am not ignorant that they are largely transmutable.

When men are suddenly subjected to different combinations of external conditions, certain changes take place in the constitution of their tissues; and after the lapse of a short time, these indicate themselves by certain appearances, when we are apt to say men have become acclimatized, which means that they have accommodated themselves to the change in their circumstances. These external changes are as various as are the original constitutions of those subjected to the test. One grows stouter, many others grow thinner; one becomes pale, another becomes sallow; one is more active, another more apathetic, and so on. We may be assured of this, that when changes in the colour, the extent, or the shape of our outward form take place, they are merely the signs of changes having been produced in our digestive and assimilative systems, and in our bloods and nerves, on which we not only depend for our colour, size, and shape, but for our lives. The changes to which I allude are doubtless brought about in the manner so eloquently described by Mr. Paget.* The impressions made on the particles of our bloods and of our tissues, through the different external conditions to which we are subjected, are different to the impressions made by those other external things to whose influence we were subjected in the locality where these particles or their progenitors first had being. As time goes on, these new impressions deepen, and in the persons of ourselves and of our children are perpetuated through the continued action of the new combination of external agents, and of that capacity which living particles have of reproducing other particles like themselves. In this way the external appearance and behaviour of nations change. But there are other kinds of change taking place in man to which it is necessary that I should here allude. In these days we hear much of the progressive development of the world from men who are spoken of sneeringly by other men holding contrary beliefs as progressionists. It is the peculiar happiness of this class of men to believe, that since organized life appeared upon the earth, it has been rising by slow gradations in its numerous forms and functions towards perfection, and that in virtue of certain capacities and tendencies with which matter was imbued originally by the Creator, it must continue to rise through a necessity as stern as that displayed in the law of gravity, until it has reached a stage, the perfection of which no human mind has yet been able even dimly to conceive. These progressionists chiefly ground their belief on a careful examination of the earth's crust, the results of which constitute the science of geology, and on observations of the play of life made and recorded in that space of time spoken of as the historical period. In the great stone book, as the earth is poetically termed, they see it clearly written, that in the natural succession of animals, the higher followed the lower; and in the operations of life around them, they believe they see perpetual change, and in the course of generations a higher kind of organization taking the place of a lower kind of organization. Molluscs appeared on the earth before reptiles, reptiles before men, the lower kinds of men before the higher kinds of men, barbarians before those who are civilized. There are still, and will continue to be, disputes about the order in which certain animals appeared; but that in the aggregate the higher followed the lower, men who have studied the subject have little doubt. Further, as I have already said, it being the peculiar privilege of these progressionists to believe that the world having hitherto progressed it will continue to progress, it is not out of place here to hint as to how these progressive changes are being brought about. Doubtless the solution of the difficulty is to be sought for and found in an examination into the operations of the natural forces in the innermost chambers of matter. The subject is still, however, shrouded in much obscurity, and we are only just beginning to get faint glimpses of the coming dawn; but these are sufficient to inspire us with hope, and to strengthen our conviction in the regularity through cause and effect of all appreciable phenomena. Schwabe, after four-and-twenty years of patient observation, reduced the chronological appearance of the sun's spots to some order. But I will give the modestly-expressed results of his observations in his own words. They were written in explanation of the tables which he furnished to Baron Humboldt at the Baron's solicitation, and published in the great outline known as the 'Cosmos.' He says, "The numbers contained in the following table leave no doubt that, at least from the year 1826 to 1850, the occurrence of spots has been so far characterized by periods of ten years, that its maxima have fallen in the years 1828, 1837, and 1848, and its minima in the years 1833 and 1843." And further on, when he considers the question as to whether these solar spots affect our atmosphere, he says, "My tables would perhaps rather tend to show that the years which exhibit a large number of spots had a smaller number of fine days than those exhibiting few spots."* This discovery, when considered alone, may appear of very little importance as far as our individual bodies are concerned, but when considered in connection with another discovery recently made by General Sabine, it assumes an importance in our eyes very great indeed. Like Schwabe, in his discovery about the appearance of the solar spots, General Sabine has discovered that the intensity of terrestrial magnetism increases and decreases over certain periods of time, and that these periods of the maxima and minima of its intensity are the same as those which claim the appearance of the maxima and minima of the solar spots.† Are we warranted in inferring, then, that the sun, being the larger body, produces these changes in the earth, and that these spots or rents in his photosphere, whatever may be their origin, are in some way the cause, or the medium through which the influence of the cause is transmitted, of some of the changes in the intensity of the terrestrial magnetism? This established, the next step in the inquiry which suggests itself is, as to the changes which follow on variations in the earth's magnetism. This question, however, is a very vast one, and, as it were, fills and penetrates the most secret corners of the realms of space, and cannot, even in the humblest manner, be touched on here. What I now wish to do is, to point out that the following propositions ought probably to be received as axioms:—

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* This is expounded by Alexander von Humboldt in a most masterly manner in his great sketch, the 'Cosmos,' Bohn's edition, pp. 148–347.

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* 'Lectures on Surgical Pathology,' p. 40; author's remarks on the connection of mind with a changing brain.

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* 'Cosmos,' vol. iv. pp. 397–399.

† See Somerville's 'Physical Geography,' 5th edition, p. 364.

(1.) That changes in the condition of the sun produce changes in the forces of the earth.

(2.) That changes in the earth's forces induce changes in the earth's crust.

(3.) That changes in the earth's crust lead to changes in the vegetable kingdom and in climate.

(4.) That the totality of these changes lead to changes in the tissues of animals, including man, and, through changes in the tissues, to changes in mental manifestations.* Further, let us consider, that as the sun influences the earth, so he himself is influenced by bodies external to him; by all the other bodies as yet discovered through the aid of the most powerful telescopes, or those which now remain to be discovered; and then, while we can understand how men are advancing in power and dignity, we may also be able to see that they cannot be studied correctly in their constitution, or in the varying conditions of their constitution, merely in connection with a certain pill, or a certain article of food, or even with a particular locality, but with the whole universe. If we remember and appreciate this grand truth, we shall never fall under the dominion of empiricism and quackery. In close connection with this question, I will allude to the changes which are daily taking place in the intensity of terrestrial magnetism in certain localities. Thus it is increasing in America and decreasing in Europe and Asia; and when from the general we descend into the particular, we find that at Toronto, in Canada, the total force in the dip inclination of the magnetic needle increases annually 1′·0, and that at London there is an annual decrease of the same of 2′·7.* This shows that a benefit or a loss is travelling westwards. Can it be true, as the Yankees continually tell us, that Europe is growing old; that having borne the burden of a high civilization for thousands of years, she is transferring it to the back of the unexhausted energies of America? and, to multiply speculations, let me state that I cannot help believing that certain changes in the combinations or in the intensity of the earth's forces, brought about by changes in the bodies external to the earth, render the appearance, or the re-appearance, or the existence of certain diseases, such as smallpox and cholera, on the earth's surface, possible,—diseases which made their appearance no one can tell how, and which, in the progress of time, will doubtless disappear in the same manner.

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* In connection with this, see Mr. Blanford's 'Abstract of Bronn's Doctrines of the Relations of Living Organizations to Matter.' ('Journal of the Asiatic Society of Bengal,' Nov. 1860, vol. xxix. pp. 428-9.)

### *Mixed Parental Influence.*

I know a father and a mother who, healthy themselves, were robbed of seven grown-up sons and daughters by consumption. Both are (for now at an advanced age, they are both alive) sprung from stocks in which, as far as they know, consumption had never manifested itself. It was, therefore, the more unaccountable and distressing to them and to their neighbours (for they are much beloved) to see one child after another, as he arrived at the age of maturity, droop and die. Now, how are the phenomena displayed in this instance to be classified? Some men whose tendency it is always to trace scrofulous diseases to hereditary origin, would assert that, were the matter properly investigated, it would be found that some of their progenitors had also suffered from this affection. As for myself, I am inclined to explain these premature deaths on the principles which are gradually being developed in the branch of science named Teratology,* which treats of those deviations in structure named monstrosities; but to understand how these should be so explained, we must go back to the usual origin of beings. The ovary of the woman produces a cell, which, in its progress towards the surface of the woman, may become impressed by the seed of the man, when it becomes imbued with certain capacities and tendencies, in virtue of which it can attach itself to the interior of the womb and grow and develope. If its growth and development progress regularly and with sufficient vigour, then a perfect animal is formed; if the contrary, then the various shapes named monstrosities are produced. I do not here allude to double monsters, or the single triple monster whose appearance has been recorded, but to those imperfect human beings whose monstrosities have clearly resulted from some defect or excess in growth and development—monsters whose monstrosities consist in the want, or partial want, of the abdominal wall, or of the head, or brain, or spinal marrow; or in having short legs and arms, and rudimentary feet and hands; or in the occlusion of natural orifices; or in some other of those modifications of regular structure whose description constitutes the incomplete science of Teratology. I have said, excess or deficiency in growth and development. Doubtless monstrosity, in the great majority of instances, results from deficiency in these processes, still excess in the same is often manifested in certain organs of monsters as compared with other organs of the same body, and with corresponding organs in so-called perfect specimens. Thus, a monster, as compared with normal specimens, may have a large head and a small heart, or *vice versâ*;

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* Somerville's 'Physical Geography,' p. 362.

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* I am indebted for my knowledge of Teratology mainly to Vrolik's article in Cycl. Anatom. and Phys. vol. iv. part ii.

and the different organs of the same monster, as compared with each other, taking the average size of organs as standards, may have some organs, as the brain and spinal marrow, very small, and other organs, as the heart and liver, very large. But I believe that there are other monstrosities, or at any rate conditions produced on the same principles as monstrous conditions, than those of mere shape and extent of tissue. I have said that the ovum, when impregnated by the seed of the man, is endowed with certain capacities and tendencies, which in their operations and results we speak of as life. Through the power which these confer on it (the ovum), it is able to draw nourishment, and thereby to expand into the perfect fœtus. Through the same, the fœtus is able to exist in the external world, and to develope into the perfect man; and the same power supports us through middle life and old age till we are seventy or eighty years old, when, becoming exhausted, we die. Now, I can imagine,—nay, more, guided by analogy, I believe,—that should these tendencies and capacities be irregularly* or unusually communicated to the ovum, we have, in addition to those conditions described in treatises on Teratology, the phenomena of short existence when the parents are long-lived; of long existence when the parents are short-lived; of delicate health when the parents are strong; robust health where the parents are weak; short children from tall parents; tall children from short parents; beautiful children from ugly parents; ugly children from beautiful parents, etc. Nor do I hesitate to use the same principles to explain certain mental phenomena, which when they appear in a man constitute him, in the eyes of his neighbours, a marvel and a prodigy. I mean this, that an excess in the processes of growth and development produced the brains of Socrates and Aristotle, of Cæsar and Napoleon, of Newton and Laplace, of John Hunter and Bichat, of Homer and Shakespeare, and of all the other great men who have in their time stood out like mountains and headlands; in the same way that a deficiency in these processes gives rise, in these times, to fœtuses without brains, or to fœtuses whose hearts are partitioned out, like the heart of a frog or a fish.

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* I do not here enter into the question as to what may be the cause of this irregularity, nor into the influence which the quality of the tissues of the mother have on the ovum subsequent to its impregnation.

If I were to be asked what forces regulate the communication of these tendencies and capacities in their intensity and direction by the parents to the children, I should answer, 'I do not know.'

### *Hereditary Transmission.*

We can never be certain that peculiarities of form and function, which exist in the parents, will be communicated to the child. I have tried to point this out in the last section. When these are communicated, then we say they have been inherited, as in the instances of gout, brain affections (insanity), and so on. When the child possesses peculiarities of form and function not apparent in the father and mother, then these are to be traced to the action of that agency which in my ignorance I have named 'mixed parental influence.' These two agencies in their operations graduate into each other, and conditions in the child are often the result of both. Between great similarity and great dissimilarity we have a connecting medium minutely and beautifully graduated. When idiots are born of idiots, drunkards of drunkards, giants of giants, dwarfs of dwarfs, etc., we say they have inherited these conditions, which render them conspicuous. We say the same of brown children born of a white father and a black mother, especially when they possess the blended moral and intellectual qualities of their parents; but when a white child is born of black parents, as is the case occasionally among Africans,* then it is apparent that the so-called laws of hereditary transmission are mere resting-places for our minds wearied with seeking after truth, and that we must refer the unusual phenomenon to a cause or causes with whose nature we are yet unacquainted.

It has been disputed by Dr. Prichard that "acquired" (he should have said improved) qualities can be transmitted. Mr. George Combe holds a contrary belief.† I need scarcely say, after what I have written under the head of climate, that I believe the weight of evidence to be in favour of Mr. Combe. Everything, however, as I have endeavoured to show, depends on the continued application, in the case of the children, of those agencies which produced the acquisitions or improvements in the parents, and the opposite. In the main, we must attribute regular transmission to those agencies, known and unknown, referred to in the expression 'inheritance,' and eccentric transmission to those referred to in that of 'mixed parental influence.'

I am aware that the above remarks are fragmentary and meagre, but I plead that the subject is a very wide one. I trust, however, in time to give them cohesion, and to illustrate them by means of papers on the causes of crime which I propose to write as my leisure and opportunities allow me. In the meantime, I trust my importunity may be overlooked if I try to impress on workers in the field of physiology how necessary to further progress it is that the minute structural and functional differences which exist among members of the same species and families should be investigated and recorded. When a sufficient number of these is known, we shall, I think, classify men, not according to their nation, but according to the nature of the materials of which their bodies are composed. And when it is definitely admitted that men have taken their characters from contact with the physical influences among which it has been their lot to be cast;* that nations and tribes take their places in the human scale according to their physical good fortune or their physical bad fortune; that the inhabitants of swamps and jungles are necessarily of lower organization than are the inhabitants of breezy and well-cultivated uplands; that through physical excellence it has been ordained we should attain unto moral excellence; that men must necessarily progress towards perfection, because the physical universe is changing and daily becoming fitter for the growth of a higher race of beings,—it shall then be seen what a glorious career is yet before the human race. We shall then cease to regard ourselves as battling our way through life, Ulysses like, the prey of unreasonable doubts and superstitions; and turning our backs upon the night for evermore, and our faces towards the reddening east, we shall walk forward in the strength of a scientific faith—a faith in the certainty, regularity, and, in the aggregate, the upward tendency of all things—to meet the coming day. Moreover, I think we shall then be also more humble, and less uncharitable than we are now; for it will then be clear that no fixed standard of excellence can be set up whereby we may test the actions of men. Unlike the metaphysicians of other times, we shall then make it our business to study the behaviour of men when acted on by adversity as well as when they are influenced by prosperity; and we shall shrink from applying the same measure to the man who is hunger-bitten and the man who is well fed, to the resident in a hovel and the resident in a palace, to the inhabitants of a crowded city and the inhabitants of the green country, to the houseless savage and to him who is heir to all the comforts of civilization.

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* Prichard's 'Lectures on Physiology,' vol. ii. chap. xv. sec. 2.

† 'Constitution of Man,' people's edition, pp. 136–152.

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* As bearing on this, read Mill's 'System of Logic,' 4th edition, p. 434.

# IDIOSYNCRASY

(*Published in the 'Indian Annals of Medicine,'* 1868.)

## I.

THE ovary of a woman throws off a nucleated cell, which is named the ovum. This apparently is homogeneous in texture. If in its course outward it does not come in contact with sperm cells of the male, it is re-absorbed or is discharged: if it does come in contact with these cells, then through the influence which it receives from them, it attaches itself to the interior of the womb, draws nourishment from the juices of the mother, and grows and developes. Its growth and development consist essentially in what is usually called differentiation of tissue and in increase in size. Differentiation of tissue is a word used to express the phenomena of bone, of muscle, of nerve, and of other tissues issuing from the apparently homogeneous tissue of the mother cell; and the extension of these to various distances and in various directions, whereby the human shape and size are attained, are the result common to growth and development. Now, the consequence of differentiation in tissues is a difference in the properties and functions of these tissues, and these differences are always proportionate the one to the other. This truth cannot be too much borne in mind. We have the external influences of the mother and of the sperm cells causing differentiation in the tissue of the ovum, and, as a consequence of this, we have a difference in the properties and functions of the different tissues, or, in other words, of the differentiated portions of the homogeneous germinal tissue. Bone does not act like muscle, neither does muscle behave like nerve, nor the nerves like the mucous membranes. Again, as a difference in the combinations of external influences leads to a difference in the tissue, it follows that the tissues which bear the same name differ in different individuals, for it can scarcely be that all impregnated ova are subjected to influences the same in every particular. It is to these slight modifications of tissue that we must attribute differences in its quality. Physiologists are now well aware of the existence of these differences, and every day we are getting better acquainted with them. These differences in quality of the same tissue lead also to differences in function. Thus the muscle which is red and dense, is capable of more muscular force than that which is white and flabby; an object green to one appears red to another; and a sound which is audible to this traveller, is not audible to that. These differences in function are all traceable to differences in the tissues concerned. I am acquainted with two brothers—twins—who are very similar in their mental endowments (or, physiologically speaking, their brain capacities), as they are in their features; but there is this great difference to distinguish them, the one is mentally energetic, the other is mentally lazy. The consequence of this difference is, one has achieved honour and a wide reputation, the other is eking out an unhonoured life as an obscure person. The difference here is also to be ascribed to a difference in brain tissue.

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* This is in continuation of my paper on Differences in Men, published in the 'Indian Annals of Medicine' in 1865.

## II.

External influences are not only the causes of difference in tissue and function, and of growth and development, but all the phenomena of life depend on their operation. If a living body could be withdrawn from all external influences, it would die almost immediately. Every one will admit this, because every one knows that food and air are indispensable to living things. When only a portion of our surroundings is withdrawn, changes short of the death of the whole body take place, but at the same time sufficient to indicate how dependent the body is on external influences for its health and perfect development. Populations which are stinted in light and heat, in a series of generations become weakly and stunted. "Imperfect nutrition, stunted growth, pallor, and the development of strumous and other cachectic diseases, nay, even of the pestilence that walketh in darkness, are the results naturally to be looked for whenever the cheering and invigorating sunlight is prevented from being shed abundantly upon the bodies of children and men."* The same tissue is differently moved by different external agents. Nay, each tissue appears to be moved by certain agents, and by other agents not to be moved at all. From this I conclude that the different tissues and the different modifications of the same tissue have affinities to certain elements of our surroundings which they have not to the other elements. When it happens, then, that these elements, which only have the power to move a certain tissue, are withdrawn, that tissue, for lack of exercise, begins to waste. By a reference to this principle, I explain the phenomena of a man becoming idiotic while undergoing a course of solitary confinement. In his cell, he may have enough of food and fresh air, and he may be kept clean and comfortably warm. But cleanliness, sufficient food, fresh air, comfortable warmth, and even light, do not make up the sum of conditions necessary for the maintenance of perfect health. He has within him tissues and modifications of tissue which require for their welfare the waving of woods and cornfields, the scent of flowers, the gleam and ripple of running water, the battling with wind and rain over plains and hills, the struggle with our fellows for life and position, the ferment of crowded cities, all the sweet variety of domestic life, and much besides : denied these, they fret and waste, and ceasing to influence the economy to which they belong, they abandon the poor prisoner to gloom, indifference,* idiocy. Our periodical rests and activities are also attributable in a great degree to the special affinities which exist between certain tissues and certain external agencies. Stimulated by the sunlight, and by the general stir of life which begins at the touch of the sun, our muscular and nervous systems awake, and go about their daily business. The motions of these tissues in the morning are free, ready, and vigorous: in the evening they flow more reluctantly. And when the sun has withdrawn his stimuli, and when, on this account, the motions of organized beings outside of us have grown so languid as to be almost imperceptible, and the stillness of night is about, these nervous and muscular motions come to a stand, and we sleep. We rest, not only because it is necessary we should do so for the purposes of nutrition, but also because of the withdrawal of those stimuli which excite the nerves and muscles into action. Further, the motions of our tissues are largely owing to certain external substances other than those which are required to replace worn-out tissues which we introduce into our bodies. Thus we take certain condiments to change the motions of our digestive apparatus, wines to modify our motions of nutrition, and certain medicines to originate, increase, or lessen special motions in certain tissues, or in portions of these, as, for instance, strychnine in paralysis. These remarks are sufficient to show that the body, for its living motions, is very dependent on the outside world: that it is altogether dependent on the same for all its motions, will the more and more appear in succeeding pages. The more intimately we trace man from the unimpregnated ovum on the one hand, to the day on which he dies on the other, the more readily do we admit that he is indebted for all the changes which he undergoes, to the influence of things outside of him. I do not, however, wish it to be understood from this, that I believe his capacities and tendencies to be also due to external influences, for I hold quite a contrary belief; external influences may modify or destroy these, but they never can originate them. Let me explain myself.

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* Dr. Norman Chevers on the Removable and Mitigable Causes of Death.

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* The degeneration of families is to be explained on the same principle. As soon as our fortunes enable us to do so, we clear a space around ourselves, and become exclusive. But immediately we become exclusive, we begin to decay : this is a physiological law which cannot be avoided.

By its inherent capacities and tendencies the impregnated ovum, if its surroundings be favourable, can enlarge itself into a body composed of bones, muscles, nerves, and other well-defined tissues disposed in certain directions. Now external influences may so far modify the force of these capacities and tendencies as that we shall have straight bodies from crooked parents, tall bodies from short parents, monstrously shaped bodies from properly shaped parents, diseased bodies from healthy parents, etc., but they can never so thoroughly change them as that the body shall wear its bones outside its skin, or its brain and spinal marrow in its chest or abdomen, or that muscles can take the place of nerves and the liver that of the kidneys. I must add that by the phrase external influences I mean the influence of everything which is not an organized portion of any of our tissues, so that it includes foods and poisons, or any substance introduced into our bodies, but not assimilated to their tissues.

### III.

I have now to define what I mean by Idiosyncrasy. When an unusual effect on any of our tissues is produced by any agent, then we are the subjects of an idiosyncrasy. This effect may be either defective or excessive, as compared with the common standard. If it is the former, then we may be said to suffer from negative idiosyncrasy; if it is the latter, then we may be said to suffer from positive idiosyncrasy. A grain of opium will in some induce dangerous narcotism, this is positive idiosyncrasy; ten or twelve grains of the same drug will in cases of delirium tremens fail to induce sleep, these are cases of negative idiosyncrasy; or the idiosyncrasy may consist in the effect produced being different in kind, as when assafœtida, which, to the majority of people, has a disgusting odour, is spoken of by some as giving out an aroma so delightful as to be fit for the noses of the gods. In the administration of medicines we meet with numerous instances of idiosyncrasy in kind; as when a remedy acts in the majority of cases on one particular membrane, and in exceptional cases on some other membrane. Ipecacuanha in most men induces nausea and vomiting, and in a few purging. Quinine in one instance cures fever, in another it produces feverish symptoms, in a third it will produce a rash in the skin; I have known this drug to produce all these effects in the same person, but at different times. One climate cures this sick man and makes that other healthy man sick. I attended a family for some years of three boys and two girls; when the younger girl was sick the others remained well, and when she got well the others were sure to fall sick. This see-saw of getting well and getting sick happened not once or twice but many times, and attracted the notice of the most unobserving among the relatives of the children. This little girl was idiosyncratic when compared with her brothers and her sister. Another case of a nature similar to the above was that of I. B., who is a sober man while living in England and a drunkard while in India. This man is voted idiosyncratic when compared with those who live soberly in both countries. Every tissue and every organ of the body is liable to be the seat of idiosyncrasy, as will be shown below. To render the condition of idiosyncrasy more intelligible, and to some extent to give it a place in the web of human life, and a value in the universal sum, I will, before giving detailed instances of the condition, offer a few further remarks on differentiation of tissue, and give a short sketch of the properties and motions of tissues so far as they are known.

## IV.

*Differentiation.*—When the ovum has been impregnated, or in other words when it has amalgamated with the sperm cells, certain changes at once begin to take place within it. The chief of these are fusion and rearrangement of particles, disposition of cells in certain directions, increase in the size of the body, and gradually appearing differences in separate portions of the tissues. These changes may be said to take place in two planes of germinal membrane. In one of these, the nervous centres, the muscles and bones with their subsidiary tissues grow; in the other, the bowels and glands are developed. The blood-vessels and many of the nerves appear to be common to both. Increase in size is termed growth; increase in size or extent in the directions which give those shapes to the tissues common to the members of the same family is termed development. Differentiation is an element of development, but not identical with it, for differentiation may go on in a tisue where neither growth nor development takes place, as for instance, when the muscular tissue gets fatty, and the bones fall into the condition of mollities ossium. The heart of a new-born infant may only have two chambers, at the same time its tissues may in every respect be normally constituted, or in other words perfectly differentiated. In physiological studies it is very important to remember these distinctions, for it is by a reference to them that we explain these modifications of tissues on which their qualities depend. Looking on the germinal membrane as homogeneous, what we see is this, at certain points motions become concentrated, and in and around the tissue where these localized and circumscribed motions play, a change takes place in the homogeneity of the structure, a change in which the processes of growth, development, and differentiation commonly play a part. And what is more remarkable than all, the results in each circumscribed field of motion are different. This is the case even when these localized motions are engaged in producing tissue which bears the same name. The auditory and optic nerves are both composed of nervous matter, but being produced in different fields of motion they are different in structure and in function. The former when stimulated excites that motion in the cerebral centres which we call sound, the latter when stimulated excites in the same that other motion which we call light. Some centres of motion, as those which give rise to the chorda dorsalis and the corpora quadrigemina, are prominent and cannot be overlooked; but, reasoning by analogy, I conclude that centres of motion are much more numerous in the developing germinal membrane than we have yet demonstrated, and that these differences in the same tissue, however minute they may be, are the result of separate centres of motion. In this way the germinal membrane in the course of its development is full of separate centres, or localized and circumscribed fields of motion like a saline solution in process of crystallization; and as no two crystals are *exactly* alike in shape and properties, so no two portions of organized tissue are exactly alike. When we are better acquainted with the intimate constitution of tissues, we shall find that no two issues are abruptly separated the one from the other by as it were a well-defined boundary line, but that, by modifications in the structure of each and in the secondary or connecting tissues, they form an unbroken chain which binds the highest to the lowest.

The ovum, in leaving the ovary of the mother, and the sperm cell, the testicle of the father, are endued with certain tendencies and capacities. Now, it is reasonable to suppose that this communication of properties will be different in different conceptions, but as we know nothing *exactly* about this abstruse process as yet, we are limited in our speculations to a consideration of the influence which the womb and body of the mother exert on the impregnated ovum, when it has to all intents and purposes become an independent individual. The ovum in the womb has, according to its limited ability, to fight as hard for its existence as the born child has to do in the outer world. The womb and body of the mother are the surroundings to the ovum, as the nursery, the nurse, etc., are to the child. If the surroundings are consistent with the life of the ovum, it will live and grow, if they are inconsistent, it will die and be cast out. They may not be consistent, with perfect life, and yet not so inconsistent as to cause immediate death. We have then the phenomena of miscarriages at various ages; and in some degree of variety in beauty of form and perfection of constitution. Variations in the surroundings of the ovum which influence its growth and development may be classified as mechanical, such as deformities in the womb and pelvis; as physical, depending on osmotic powers of the membranes and their adjoining liquors; as electrical and chemical, the consequence of the rapid growth of the womb; and as vital or the processes of nutrition going on in the tissues of the womb. Variations in these processes and conditions necessarily induce changes in the imprisoned ovum; knowledge of these, however, is still in its infancy. Nor does differentiation of our tissues stop at our birth; on the contrary, it goes on till the day of our death. And this gives rise to the phenomena of infancy, youth, manhood, old age, and death itself, of disease and health, and of the various changing conditions which lie between these. Death from old age is thought by some to arise from the inability of the tissues to keep themselves moist; granting this to be true, it is not less true that this inability which tissues experience is the result of the differentiation which contact with their surroundings compels them to undergo. The skin affords a visible instance of the differentiation which tissues undergo, as the consequence of increasing age. Soft and smooth in youth, this tissue grows rougher and less elastic in middle age, and leathery in old age; and it does so in spite of the means used to preserve its youthful properties. From all this it appears that while the friction of the organism with its surroundings leads to life, the same leads to that differentiation which ends in death. Disease is but a too rapid differentiation of our tissues; and before closing this section I will speak a few words about contagious disease. The inability of many to conceive it to be possible that external influences should so differentiate some tissue or some portion of a tissue as to enable it to multiply itself in some other tissue favourably disposed to such multiplication, is a great stumbling-block to them, and leads them to search about for some special poison as the cause of certain epidemics, when they should be seeking for it in certain combinations of external influences, such as I shall hereafter hint at in my section on the analysis of our surroundings. A certain breed of short-legged sheep, Darwin tells us, was got in England by selecting two monstrously short-legged members of a long-legged breed and breeding from these. Now the causes which monstrously produced these short legs represent in the parallel the epidemic causes of disease, and the short-legged progeny of these represent in the same those cases, say of smallpox, propagated by touch. These cases are strictly parallel; and if the principles on which they are severally based be not identical, they are at any rate very nearly connected. In both we have differentiation by external influence in the first instance, and propagation by contact in the second.

## V.

Here then we have a great number of different tissues curiously and intricately interwoven into a wonderful web, and folded into a shape which we designate human. Now, in imagination, let us unfold this web and spread it out before us as we would a map. And let us further suppose that we can both arrest or call into action through the medium of some stimuli at our command all the varied motions of which it is capable. This moment it is at rest, but we breathe on it, and as the landscape is stirred into motion by the moving wind, so it breaks into life so complex and wonderful that the human intellect in trying to explain it, is, as yet, like a child which has lost its way in the dark. Now what is most noteworthy here is that each modification of tissue acts according to its nature, or in other words, the degree to which it has been differentiated. But to illustrate this physiological truth we need not have recourse to imaginary instances, for we have a real one in the case of a man frozen in snow drift. Frozen, the motions of his tissues have come to a standstill, but let us apply heat, and when he begins to thaw the motions of life will reappear. Under the continued application of excessive cold the different tissues will become insensible to external stimuli in something like the following order,—the mucous tissues with their glands, the voluntary muscles, the brain, the muscles of respiration, the heart; and on the application of heat the motions will reappear in an inverse order; but it is to be marked that as each tissue begins to move again, it reassumes its proper function, and not that of its neighbour; the muscles do not usurp the office of the nerves, nor the liver that of the kidneys; but each, true to its nature, acts its own proper part with the same certainty and precision as does the sun in his rising and setting. In studying the motions of human bodies it is convenient, if it be not strictly correct, to consider each body as composed of individual atoms, just in the same way that substances are chemically considered to be composed of individual atoms; and the study of the functions of the human body will ultimately be thoroughly understood only when the behaviour of its component atoms has been individually considered. The study of atoms at once presents itself in two divisions, (1) that which refers to their individual existence, and (2) what refers to them as constituents of the general body; each atom has, therefore, two classes of duty to perform, viz. its individual and its functional or social duties. Its chief individual duties relate to its own nutrition; its social duties relate to the general life and welfare of the body. Now the first step in this study is to ask what are the properties of the atoms, and the motions of which they are capable. In the present state of our knowledge we can only hope to give a very partial answer to this question, but our hope in asking it is not to answer it fully, but to be able to point out the way along which we must walk if we would find the truth.

All our atoms have gravity. This property is partly neutralized and obscured by their vital properties, as is seen in cases of œdema from debility. Weak gravitation leads to œdema; stronger, vitality reasserts itself, and the œdema disappears. A familiar instance of the effect of gravity on the living tissue is what follows to a man when he is hung up by the heels. All our atoms with reference to each other, and whether in the solid, semi-solid, or liquid state, have the property of cohesion; and many of them are endowed with one or more of the modifications of this property, viz. hardness and elasticity, brittleness and ductility. As cold is favourable to the cohesion of particles, and heat unfavourable to it, it follows that in the cold of winter our tissues cohere more vigorously than they do in summer.

The property of adhesion, that is the ability which one particle possesses of cohering to another dissimilar in nature, is common to most of the tissues in the body, and some of the most important bodily processes are referable to this property. Capillary attraction, which is but an illustration of the power which liquids have of adhering to solids, is a power by which many important processes of the tissues are carried on. Liquids dissimilar in nature have also the power of adhering to each other, or in other words mixing, and this irrespective of whether they are light or heavy. Nor is the exercise of this power prevented by thrusting a membrane between the liquids, nay, in this way it is often facilitated. According to the relations which the separated liquids bear to each other, and to the membrane which separates them, will be the facility with which each can transude through the membrane. This process is named osmose; if it go on inwardly it is called endosmose, if outwardly it is called exosmose. Motions produced by osmose abound in the body; every cell containing fluid and floating in fluid, every tube containing fluid and immersed in fluid, and every membrane which has a fluid on each side of it, the one differing from the other, is a theatre for the action of osmose. It is thought that many diseased conditions arise from derangements in this process, and these are corrected by remedies which have the power of changing the direction and modifying the strength of the osmotic currents. Carbonates of potash and soda direct the current one way, while dilute acids and solutions of acid salts direct it in the other. And while some salts, as for instance, carbonate of potash, increase the osmotic power of another salt, chloride of sodium decreases it. The flow of fluids through tubes, while but little influenced by the material of which the tube is made, is much influenced by the composition of the fluid itself. Thus Poiseuille found by experiment that iodide of potassium injected into a horse's veins hurried the current, and that solutions of other salts retarded it, just as they do by currents flowing through glass tubes. The processes of sweating and purging from the administration of medicines are doubtless in some cases brought about in this way. "If a moist thin bladder be distended with air and suspended in a jar of carbonic acid gas, the carbonic acid, being soluble in the water with which the bladder is moistened, is conveyed through its pores by adhesion, and passes rapidly into the inside; the air in the interior is but sparingly soluble, and is transmitted outwards very slowly; the carbonic acid consequently, notwithstanding its lower diffusive power, accumulates within and at length often bursts the bladder."* This experiment illustrates the power which different membranes have to change the diffusive or adhesive power of gases, as also how the oxygen is dissolved by the moisture on the surfaces of the bronchial tubes, and how the membranous walls of these tubes and of the capillaries on their surface, influence the exchange of gases between the blood and the external air. As a rule, heat lessens and cold increases the adhesive powers of substances. A certain amount of chemical change takes place on the surfaces of the membrane which is the theatre of endosmose and exosmose; from this it appears that osmose is the process which links purely physical processes with purely chemical processes, and so preserves the upward chain unbroken.

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* Miller's 'Chemical Physics.'

Chemical affinity, assisted by the influence of the living tissues, is the fruitful and unintermitting source of motions in these. Food is taken into the mouth, masticated, and swallowed. In the stomach it is acted on by the gastric juice, partly absorbed, and then forwarded on into the bowels for further digestion and absorption. Absorbed directly into the blood, or intermediately through the lymphatics, it is brought into intimate contact with tissues made needy by warring against or replying to the stimuli of the external world. By these it is used up in healing or replacing the particles which have been worn out in the battle of life; and in time it is itself thrown out of the system as worn-out material, in the shape of uric acid and urea, lactic and carbonic acids, compounds of sulphur and phosphorus, and in several other forms which, because their uses are as yet but little understood, are termed incidental. In this round of ingress and egress the food provokes much chemical action. In the mouth it is wetted with the secretions of the buccal and maxillary glands; in the stomach, the gastric juices hasten to make it into a pulp, to overturn the old arrangement in its atoms, and to institute a new arrangement in them. In the duodenum and the bowels, the liver, the pancreas, the glands of Brunner and Peyer further shuffle the atoms and bring them within the influence of the absorbents; these, with the assistance of the blood, the spleen, and the liver, further elaborate it into a substance, or rather substances, termed proximate principles, which, if not living, are on the threshold of life. These appropriated by the different tissues, according to their nature and necessities, assist in discharging the functions of the nerves, the muscles, the excreting and secreting apparatus, and of the bones and connecting tissue, after which they fall within the dominion of the excreting apparatus, the chief of which are the skin, the lungs, and the kidneys. In its journey towards becoming living tissue, the food is built up into compounds of a complex nature; in its journey towards extrusion from the body as worn-out material, it is resolved into substances more simply formed. In the former we have instances of synthetic chemistry, in the latter of analytic.

Pasteur discovered that a crystal under certain conditions can repair a chip in its structure, just as the skin heals an ulcer on its surface. This is one of many instances showing how insensibly the physical and chemical world merges into the vital.

*Ciliary motion* can scarcely be called a vital motion, as evidence is in favour of the conclusion that it is the result of the process of osmose.

*Nutrition* is that property or motion which leads to the repair of those particles which have suffered from the exercise of their functions or use. All tissues are differently constituted, but each finds in the blood the pabulum which is necessary for its repair. The capacity to select through chemical and physical motions the elements necessary for its repair, to arrange these in the forms which are suitable, and to place them within itself as portion of its living material, constitute the property of nutrition. All living tissues possess this property.

*Contractility.*—All muscles, whether voluntary or involuntary, have, when properly stimulated, the power of shortening themselves. This is the motion of contractility; through it locomotion is brought about, the blood is circulated, the food is urged forwards, we speak, express passion, ideas, and feelings.

*Nervous motion.*—If we take a bar of iron and heat it at one end, the opposite end in a little while will also become hot. The heat applied at one extremity travels to the other. Heat applied at one point is conducted to another point at some distance. When we ask how this conduction has been achieved, we are told it has come about through the motion of the constituent particles of the metal the one on the other. This answer is unsatisfactory enough; but it is all that the backward state of science enables us to give. Well, just as heat is conducted through the bar of iron, so the impressions of external objects are conducted through the sensory nerves, and, indeed, through all nerves. The analogy is perfect; but this other question at the same time offers itself, "How is it that motor nerves cannot conduct the impressions that sensory nerves can, and how is it that the sensory nerves cannot communicate the messages of the grey matter to the muscles?" I answer this question in this way: "We cannot tell why, but just as it is necessary, in the economy of things, that heat should undergo transmutations or modifications before it can traverse certain substances, so it is necessary that the condition of motion in a sensory nerve should, in some way, be changed in the grey matter before it can be transmitted onwards in the motor nerves; and as heat in passing through a thermo-electric pile becomes or generates electricity, so the nervous influence in passing through the nervous centres is changed and reappears in the motor nerves as something different." This is the chief function of all nervous centres, that they should in some way change the modes of motion communicated to them from without. And having conceived this, we begin to understand how the motions of the nerves of special sense are transmuted in the brain-tissues into those nervous conditions known as pain and pleasure, hope and joy, anger and love, memory, reasoning, and the play of fancy, etc.

While these motions and processes are going on in the tissues, they generate two forces at least; these are, electricity and heat. All chemical action is attended with the generation of electricity. If we take some pieces of antimony and bismuth and arrange them so that they touch each other in certain ways, and then if we heat or cool these in different degrees, we produce currents of electricity; and it is believed by Nobile Matteucci and others, that if different organized tissues impinging on each other be unequally cooled or heated, similar currents are produced in them. In all animals muscular contraction originates electricity, which travels from within outwards. Heat is generated in the body chemically and vitally,—chemically when oxygen gas combines with the carbon of the tissues, vitally when the muscles contract and the brain works. It becomes latent when the proximate principles merge in the living tissue, again to reappear when these are thrown out as waste material.

I will briefly recapitulate. We have physical, electrical, chemical, and vital motions going on in our tissues, and I enumerate these in the supposed order of their importance. But as the life of the body depends on *all* of them being carried on with a certain breadth and intensity, we cannot separate them in our physiological studies. We cannot say, Here begins a physical motion, and here ends a chemical. Indeed they so act and react on each other, they are so mutually interdependent, and they so shade off the one into the other, that they must necessarily be studied with reference to each other, if they are not to be considered as mere modifications of each other—modifications originating in the differentiations which, from the influence of external things, have taken place in the impregnated cell. It is probable that physical properties and motions predominate in the connective tissues and bones, chemical in the mucous and glandular, and vital in the muscular and nervous. In studying the body, therefore, we must always do so as a whole, and this whether we are considering it physiologically or pathologically. It has hitherto been too much the custom in the study of disease to fix on some particular tissue as the chief evil and spring of all the diseased actions of the body. This tissue varies according to the whims of men and the progress of our knowledge. At one time it was to be sought for among the fluids; and the blood, as being the most important fluid, was thought to be the harbour of various poisons, from whose action all diseased conditions proceeded. Then the evil was to be found in the solids; and for a long time the liver was fixed on as the fountain-head of almost every malady; although it subsequently shared this honour with the mucous membranes and the spinal marrow. One after another of these hypotheses have had to be abandoned, as our knowledge has increased, and now it is growing the custom among us to view the body not from the stand-point of any one organ or fluid, but molecularly, that is, as a whole and in its intimate constitution. This method of study necessarily compels us to consider the diseased tissues in connection with the properties and motions that I have above described, viz. physical, electrical, chemical and vital, and the modifications and intermixture of these. When this method is thoroughly inaugurated and vigorously pursued, the science of disease will rapidly increase. At present I am not aware that any attempt has been made to analyse a disease according to its motions, and show where that is deficient and this is in excess. In a vague hazy way, we say there is excess or deficiency in the vital processes, scarcely suspecting that very serious diseases may follow on deficiency or excess in the physical motions of the body only. Some diseases are purely physical, or rather mechanical; such for instance are the various dropsies, and the diseased conditions which are the consequence of the pressure of tumours; but I think that the mechanical obstructions which lead to those can never arise without the consent, as it were, of the body generally. A man receives a bullet in his liver, but this does not lead to abscess of the organs unless the body generally, resenting its intrusion, falls into a state of fever. The state of fever is, as it were, the substratum on which all other diseases are based and erected. This doubtless increases or diminishes, according to the circumstances, all the motions of the tissues. Here it increases osmosis, there it stops it; here it increases nutrition, there it stops it; here it increases nervous motion, there it stops it; and cases are slight or serious, according as these motions differ in their intensity from that standard which gives health to the body in which the fever is manifested. This great substratum for disease may affect a very limited portion of one tissue, or it may affect almost every portion of every tissue at one time. At a certain time of the day some patients suffer from fever as is manifested by increased heat in a portion of their skin, not larger than can be covered with a teacup; while in that fever named the Hooghly fever, every tissue seems to be affected. Fever also differs in different instances in the intensity with which it moves. In the Hooghly fever, motion is not intense, but it is first deficient and then stops; there is little waste of tissue, simply because there is little chemical, nervous, or muscular motion going on. But in typhus fever there is great expenditure of tissue, in nervous motion and in chemical motion, while the motions of nutrition are in abeyance, and consequently the patient becomes lean, whether he dies or lives. Fever may also act steadily in one direction for many days, or it may travel through most of the tissues, becoming differentiated as it goes, in a few hours. For instance: James Ramsay, boiler-maker at the Borneo Company's factory at Burranagore, was in July of 1865 seized with cholera; that is to say, he suffered from rice-water evacuations up and down, cramps, clammy sweats, sodden hands, cold tongue, and husky voice. These symptoms passed off in a few hours, and were succeeded by those of fever, viz. hot skin, rapid pulse, and copious perspiration. The second morning he was weak, but otherwise well. On the third day he was seized with symptoms of dysentery. On the fourth day the dysentery declined, and the diseased motion overflowing his brain and nervous tissues, he died with symptoms of heat apoplexy in the night of the fourth day. If we substitute the word 'motion' for the word 'spirits' in the writings of Sydenham on Hysteria, then we have in the pages of this illustrious author an accurate description of the rapid and eccentric flow of vital motion in the human tissues. In no disease is the vital motion, that is, motion in the nervous and muscular tissues mainly, so fluent, wide, and erratic as in hysteria; and in no being is the vital motion more easily excited than in a hysterical woman; an odour, a sound, a sight suddenly disclosed, nay, a taste, is sufficient for the purpose.

Temperament depends on the motions of our tissues; if these are quick and fluent, then we are sanguine, if they are slow and laboured, then we are phlegmatic. Habit is a periodic ebb or flow in the motions of tissues in certain directions. This habitual ebb or flow, however, depends a good deal on the influence of certain combinations of external objects acting periodically. When these are suddenly and altogether withdrawn, the habit grows weak, and is more easily broken. Take for instance the habit of drinking at certain hours of the day. It is by many little signs in the life around us, over and above the want within us, that we are reminded to take our habitual dram; so, when we are removed to another locality, where the play of outside life is different, we miss the familiar hints, and in this way the habit, being in a measure unsupported, becomes more easily conquered. The motions of the brain tissues constitute what we call mental phenomena, but to the comprehension of this truth it will be necessary for me first to make a few remarks on two properties which all vesicular nervous tissues possess. I will do this in the next section.

## VI.

I think on reflection it must be admitted that all grey nervous matter is gifted with consciousness wherever located, and that the consciousness of every portion of grey matter is fundamentally the same. I mean this, that all the grey matter has a substratum of consciousness common to all. On this is engrafted, in different portions of the nervous web, according to the degree of differentiation which they have severally undergone, certain other properties, which, when exhibited, we name instinct, passion, intellect, etc.

If we tickle a sleeping infant's palm, the fingers close. The explanation of the phenomenon is this: The impression made on the palm sets going a motion in the sensory nerves of the arm, which in turn is communicated to the grey matter of the segment of the spinal marrow where these nerves originate. Here having undergone some change which enables it to travel along a motor nerve, the motion proceeds along the motor nerves of the arm, and is transmuted into muscular motion in the muscles of the forearm and fingers. Now, the act of consciousness here, is the recognition of the impression, and the transmission in a definite direction of the motion excited by that impression. If we remove the bandage from a timid man's eyes, when, unknown to him, we have placed him close to a light burning brightly, he will start back, and, as it were, put himself in an attitude of defence. Here the impression on the retina excites a motion in the optic nerve, which, travelling inwards through the grey matter, where the so-called instinct of self-defence resides, it is there modified and transmitted onwards along the nerves (probably also through the cerebellum) which supply the muscles, called into action in the start and attitude alluded to, where, as in the case of the infant's hand, it is transmuted into muscular motion. The chief difference between these two classes of phenomena is, that in the latter instance the motion excites a greater width of grey matter, and calls into action more muscles.

Peter the Great of Russia, when he saw a man in a yellow wig, became so violently infuriated, that he foamed at the mouth and behaved murderously. Here the external impression excited a still wider stretch of nervous matter, and through this a greater extent of muscular tissue. Now in these three instances consciousness is clearly traceable; by consciousness I mean, as I have already said, the power to comprehend the arrival of motion from without, and to transmute in some way, and then to transmit onwards in a definite direction, that motion. In the first instance, the consciousness is in the spinal marrow; in the second, it is somewhere about the medulla oblongata; in the third, it is in the ganglia lying at the base of the brain, or in the lower cerebral lobe. In explaining why these differences should exist, I must consider another property which all grey nervous matter possesses,—this is memory. If the amount of this property possessed by any portion of grey nervous matter were to be represented by a shade of some colour, say blue, then the spinal marrow would have the tint of a very weak solution of quinine as it sparkles in the sunlight, while the posterior lobe of the cerebrum would be of the hue of indigo. For the manifestation of reflex nervous action, memory is hardly necessary; for the manifestation of instinct, it is more necessary, and for the manifestation of sustained passion, it is more necessary still. For those sustained intellectual motions which led to the discovery of the laws of gravity and of the motions of the planets, the highest form of memory is necessary. That the spinal marrow has a trace of memory is understood, when we analyse the movements of the lower limbs in dancing, the effect of habit on the lower gut, etc. In instances two or three above described, it is also clear that memory is an element of the phenomena, but it is not so clear that the property (of memory) is resident in the grey matter which moves the muscles that express the instinct and the passion. We have no positive evidence that it is, but we have negative evidence after this fashion. Animals which have no cerebral lobes are nevertheless capable of anger, and memory being necessary for the fully developed passion of anger, it follows at least that memory is possessed by the tissues lying below the cerebral lobes. Again, in disease a man may lose his memory for dates or figures, or names or faces, or localities only, and yet retain his memory for other things; now this could scarcely be if all our memories were crowded into one portion of nerve tissue, specially reserved for the purpose. Further, it has been observed that the memories of great men are in proportion to their intelligence; the greater the extent of the tissue where the intelligence resides, the greater the memory. Cuvier's brain weighed ten or twelve ounces more than the average weight of adult male brains, and his memory was very great. It is more in accordance with the evidence at present at our disposal, to look on memory as a property diffused throughout the whole extent of the cerebral and spinal grey matter rather than as the special property of a special organ. Many find it difficult to realize to themselves how it is possible for the experiences of a lifetime to be stored up in the brain tissues. I will try to help the faith of these men with an illustration. I take an English Bible and show it to a savage who is ignorant of the history of the civilized world, and who has never heard of printing, and I tell him that on its pages are written strange and eventful records; records of men's lives, of the rise of nations, of wars and treaties, of the origin and establishment of religions, of the decline and fall of empires, etc. He listens and looks, but the crooked characters in which these histories are traced, excite in him fewer ideas than the surface of the barren country to which he is accustomed does. He sees so many ounces of paper covered with black tracings, but they are as blank to his mind as so many ounces of wood or stone. To the same savage I show a human brain, and in like manner I tell him that within its folded structure is written the record of an eventful life. Here is the account of our struggle for position, there the story of our loves and ambitions. Within this fold lies the tale of our joys and triumphs; within that, of our sorrows and bereavements. Here are the traces of fluent and flexible childhood, here of a gushing and enthusiastic youth, here of a cold and resolute manhood, and there of a selfish old age; and see over all the intricate web, hopes and fears are scattered like the lights and shadows of a landscape. He looks and listens, but the folded tissues, as in the case of the written leaves, impress him no more than so much wood or stone does. Reasoning in this way, we are able to see how it is possible for fifty or sixty ounces of brain tissue to be the sheet on which are impressed the varied experiences of a life, and how the time may come when by the assistance of apparatus we may by innumerable comparisons come to be able to read those impressions as easily as a Fiji savage can be taught in these days to read the printed Bible. If my theory of memory is correct, the kind of memories possessed by each portion of vesicular nervous tissue will be in accordance with the peculiarity of its differentiation. The spinal marrow will possess the memories of reflex actions; the medulla oblongata and cerebral ganglia, of reflex actions, instincts, and brutal passions; the cerebral lobes, of knowledge acquired from books, men, and our experience of the outside world, and from our reflections on this. And the kind of memory recalled by any cerebral motion will be in accordance with the nature of the tissue through which the motion is travelling at the time that the memory comes back on us.

## VII.

I will now remark on the cerebral motions which give rise to mental manifestations through muscular expression.

A man may be irritable from known causes or from causes known neither to himself nor his friends; when he is irritable from known causes, he is so intelligibly; here the motion which stirs his peevishness or anger travels from the tissues of intelligence to those of passion. When he is irritable or passionate without cause, the motion is limited to the tissue of passion, and it has been excited directly in that by some external influence, or it is the result of some change in the condition of the structure which renders it diseased. When a man is excited to lust by the women around him, he is so intelligently. But when a man is an erotomaniac, then is the tissue, which is the seat of desire, diseased, or it is kept more or less continuously in motion by some other motion flowing steadily in on it from some other portions of the tissues, a motion which we call sympathy. Every portion of our nervous centres are, I imagine, capable of being moved in these two ways, and in explaining idiosyncrasies it is important to remember this.

Intelligence is not quite the same thing as memory, but without memory there could be no intelligence, for to be intelligent in the least degree it is necessary we should remember. Yet a man may have an amazing memory and not be thought intelligent; he may have read and seen much, and he may remember much or nearly all of what he has seen and read, and yet his neighbours may not give him credit for knowing much. How is this? Metaphysicians say, because he does not abstract, compare, and deduct, or, in other words, he does not reason. Physiologists, on the other hand, say there is but little interchange of motion between the differently differentiated portions of his brain, or, in familiar phrase, there are no railroads or electric telegraphs in his brain. A man who reasons, first fixes his attention, or rather he has his attention fixed for him; something occurs to interest him. Interesting him means that some influence has strongly impressed some portion of his brain tissue. This may be in the tissue of passion or intelligence. Next around this impressed point, which is the point of attention, motion is free and rapid, just as it is around the point in the germinal membrane where the optic tract begins to be formed.

Indeed the concentration of motion in the germinal membrane at fixed points is analogous to the concentration of motion around the points of attention in the developed brain. From this centre of motion, this point of fixed attention, there are outward streams of motion, and to the same there are inward streams. These streams wake the memories of the tissues which they traverse. In a dull stupid man these streams will be short, in a man of genius they seem to traverse the whole extent of the cerebral tissues, exciting passion, feeling, and intelligence as they go. The former is a short-sighted man, the latter is a poet like Shakespeare, or a philosopher like Adam Smith. These motions after a time may come to an equilibrium, when we say we have arrived at a conclusion; this conclusion is an opinion or idea and can be remembered, it may be called a compound memory; a man who possesses a store of these compound memories is usually a wise man.

The simple memories are the impressions which external things make on our brain-tissues. These are necessary to the formation of ideas or compound memories; hence there is a physiological necessity why young children cannot reason. Some men's brains have the power, when stimulated, to shift the point of attention from one tissue to another; I imagine this is what metaphysicians mean by abstraction. The brain which can do this easily, and without losing command as it were over the currents, is a superior brain to that which cannot.

But to recapitulate, consciousness is a property possessed by the spinal as well as by the cerebral vesicles, and is the fundamental property of nervous matter, in which all other properties are overlaid. Memory is a property also possessed by the vesicular matter of the spine and brain. Existing in the minutest traces in the former, it increases in extent and intensity as we proceed upwards until it reaches its maximum in those tissues where the highest intelligence resides.

On consciousness and memory, according to the degree of differentiation which the tissue has undergone, we have appetite, hunger, lust, etc.; instinct, such as to make fire, build honeycombs, houses, dams, etc.; feeling,—anger, gratitude, hope, etc., and intelligence overlaid.

Conditions brought about by the motions excited in us through impressions made on our nerves of special sense by external things are our simple memories; and the more complex stores of memory are the results of the operations of those centres of motion, or fixed attention which, remembered, we call ideas, opinions, generalizations.

When the cerebral motions excite the memories in any other order than that in which they were acquired, we have the play of fancy and imagination.

When any portion of our cerebral tissues is so strongly impressed that it becomes for the time the point to which and from which the leading streams of cerebral motion flow, then our attention is fixed.

These streams flowing to and from this point, we call reasoning; and when these streams have balanced each other, we have arrived at a conclusion or generalization.

Conclusions are those conditions of the cerebral motions when in concentrated form they tend to pour themselves upon the muscles, and so become transmuted into walking, talking, writing, the gestures of passion, etc. This pouring of the cerebral motion on the muscles, we call the exercise of the will; and the character of the so-called voluntary motion will be according to the locality of the grey matter in which the conclusion is reached, is situated. If it be in the tissue of passion, it will be passionate; if among the instincts, it will be instinctive; if in the regions of intelligence, it will be intelligent and deliberative.

When the brain is labouring around a fixed point, and a conclusion is being arrived at, each portion of the tissues through which the cerebral currents are flowing strongly, has a tendency to divert those currents and pour them on groups of muscles, and in this attempt each succeeds more or less. It is owing to this tendency that we can read what is passing in a man's mind from the expression of his face; now he has a merry look, now a passionate, and now again a thoughtful expression. When the attention is frequently shifted and a conclusion as often reached, we have an active decided man, as was Napoleon I. When the cerebral motions have no point of attention sufficiently fixed around which they may gather to work out a resolute conclusion, then they wander here and there without system, waking the memories irregularly, and we have the brilliant, vacillating, promiscuous mental manifestations which characterized S. T. Coleridge.

It is more easy for the cerebral motions to converge in the lower brain tissues than in the upper, and on this account it is that men are more often passionate than they are intellectual. A man will be lustful, avaricious, ambitious, intellectual, etc., according to the tissue in which the point of attention, around which the cerebral motions gather, is oftenest placed. Truth and falsehood, it appears to me, depend on the tone of the tissues rather than on the process of differentiation, as also courage and cowardice. If the tone is low, a man will be cowardly and untruthful; if high, brave and truthful. When the cerebral motions habitually converge in the highest brain-tissues, then I think we have the phenomena of intelligent adoration. The man who owns a brain of this quality does not worship because he is told to worship, or because his father worshipped before him, but having gauged or tried to gauge the extent of human knowledge, he discovers that after all worship is necessary, and prostrating himself with all the living motions of his body before the Great Inscrutable, he worships without speech.

When the tissues are incapable of retaining a strong impression, such as might serve as a point for the attention to fix itself, then the cerebral motions flow hither and thither with but momentary halts, and then we have the delirium of fever, or of acute mania. Each tissue through which the motion flows acts, as it is stimulated by the motion, on the muscles with which it is reflexly connected, and in this way the patient will be angry, sentimental, murderous, and so on in a few seconds, according to the tissue stimulated.

I explain the association of ideas or memories thus: In Section II. I endeavoured to point out that our tissues, according to their differentiation, have more or less affinity for certain influences; or, in other words, this tissue is more easily moved or impressed by a particular stimulus than that is. In this way one portion of our brain tissues is impressed by one stimulus, and another by another; and similar tissues are impressible by similar stimuli, the remaining portions remaining unimpressed. Light moves the optic tract and fails to move the auditory, while sound moves the auditory tract and fails to move the optic. This understood, it can then be easily grasped that the stimulus which rouses any memory will more readily rouse the memories assimilated to it than those other memories which are comparatively dissimilar; and this for the reason that those cognate memories are written on tissues, in differentiation, more closely resembling each other than they resemble those tissues which possess memories which are less cognate.

## VIII.

In the above sections I have laboured to prepare the ground for the statement that all idiosyncrasies depend on differences of structure, and are consequently so many illustrations of the great law that differences in structure lead to differences in function. They further show that different degrees of differentiation endow men with different degrees of susceptibility to external influences; or, in other words, when men differ in their structure they are moved differently by the things which surround them. Having said this much, I will now give special cases of idiosyncrasy. I will only relate so many as are necessary to illustrate the proposition that each and all of our tissues are liable to be the theatre of the affection, and I shall refrain, as far as I am able, from detailing cases which are not necessary to this end. The text will, on this account, be the clearer, and the collection will form a link in the chain of argument, and not merely a bundle of anecdotes.

## IX.

(1.) ——, engine-driver, came to me in 1865, suffering from erythema of the face and neck. He was otherwise pretty well. I prescribed lead and opium wash, and the irritation subsided in twenty-four hours. A few days subsequent to this, he returned with the disease as bad as before. The same remedy was prescribed, and with the same result. About a fortnight later he came a third time, with his face and shoulders swollen, and of a fiery red. It now occurred to me that eating shell-fish might be the cause of the complaint, and on being questioned, the patient confessed to being immoderately fond of prawn-curry. I explained the case to him, and since then, while he has abstained from the dish, he has continued well, but as a rule, as often as he has indulged in it, he has had a return of the erythema.

(2.) E. C. suffered much from intermittent fever in 1865. For this I at first gave him quinine. After taking the remedy for a day or two, he began to suffer from a rash on both sides of his trunk and on his belly, which very much resembled prickly-heat. I ordered the affected surface to be covered with a mixture of chalk and violet-powder, but this gave him no relief, and the itching becoming intolerable, I omitted the quinine, and prescribed arsenic. The rash in two days afterwards had almost disappeared. Suspecting that quinine had caused the rash, I prescribed it again a few days subsequently, and was not surprised when the rash returned. A few weeks later I tried the remedy a third time, and with the same result.

(3.) N. C. suffers from the goose-skin when he listens to the sound which paper gives out as it is being torn.

(4.) G. S. writes to me, "As soon as fish comes on the table, and I desire to eat it, my nose itches intolerably, and continues to do so till the fish is removed."

It is to be noted that the agencies which produce these affections of the skin, do so through various channels. In the first and second instances above given, they acted through the stomach, in the third through the ear, and in the fourth most probably through the eye and organ of smell.

The following cases are illustrative of idiosyncrasy of the gastro-intestinal canal:—

(5.) In the 'Indian Medical Gazette' for October, 1866, the editor says, "We once heard a professor of moral philosophy announce a fact which may, we think, fairly claim a place in Dr. Bird's collection. The professor's wife purchased for their drawing-room one of the fashionable and much admired prize carpets of the first International Exhibition. The lady was much pleased with her investment, as were all her visitors and guests. But her pleasure was qualified when she discovered that the combination of the carpet colours was so peculiar as to cause a sense of unconquerable nausea to her husband every time he entered the room. It was no whim or fancy. Being a man who was deeply versed in the philosophy of the senses, his interest was greatly excited by the fact, in spite of the painful nature of the peculiarity which had been discovered. He placed himself time after time in an experimental spirit *en rapport* with the carpet. Invariably, however, the same sensation of sickness was produced, until, as he said, entering his drawing-room to receive guests became as interesting as passing from Dover to Calais with a fresh breeze and a chopping sea.

(6.) Closely resembling this was an idiosyncrasy from which I myself suffered when a child. A pale greenish-blue colour, like that of verdigris, always made me sick. The peculiarity caused me much discomfort for some years, but I gradually grew out of it.

(7.) Dr. Colles, writing to me from Sunawur, says, '— —, Commissariat Officer here, whom perhaps you knew in

Calcutta, cannot enter a room where a cat is, even though he does not see it, without being attacked with nausea and prostration. He says that on one occasion he and an officer of the Civil Service who suffered from the same idiosyncrasy, were dining at a strange house, and became so ill as to attract the attention of their host, who, when they told him they were certain there was a cat in the room, stoutly denied the possibility of such being the case. But on searching the room a cat was found."

(8.) My friend Dr. Abbey, now in Burmah, tells me that as often as he smells patchouly, he is seized with diarrhœa.

(9.) — —, of the Carriage Department, East Indian Railway, was in the Howrah Hospital for general ill-health, in September, 1868. One morning, when I ordered him mutton diet, he asked me for beef instead, because, he added, mutton always gave him dysentery, and that he had not eaten it for years in consequence. I told him I did not quite credit his statement, but that he should have beef to-morrow if to-day's mutton upset him. The next day he was suffering from violent diarrhœa,. and altogether very ill. The mutton diet was withdrawn, and the following day the bowel-complaint had subsided. Some time after, I wished to repeat the experiment, but the patient flatly refused to be the subject of it.

(10.) Sydenham says, "Some women in the smallpox cannot bear diacodium, because it occasions giddiness, vomiting, and other hysteric symptoms." (Wallis's 'Sydenham,' vol. ii. p. 141.)

In these cases we have instances of external influences producing in an unusual manner affections of our stomach and bowels through the eye and nose, and by direct application to the coats of the stomach. I am unable to guess at the channel through which the emanations from a cat disturb the equilibrium of the body, or what these emanations are.

The following are cases of bladder idiosyncrasy:—

(11.) A. R., a schoolfellow of my own, was the subject of a very curious idiosyncrasy, of which he was very much ashamed, and his statements about which were not always credited. It was this, he could not smell sweetbriar without being seized with a strong desire to make water. That which I laughed at and refused to believe as a boy, has a deep significance for me as a man.

(12.) About eighteen months ago I had a little patient, a boy of three. His disease was, that he made water as often as he was seated on silk. Every lady robed in silk who lifted him on her knee, had cause to regret her attention to the little man. Dresses made of other stuffs did not have the same effect on him. He was then sickly; he is now well, and appears to have overcome the weakness, which at one time promised to outlaw him among women.

Shakspeare and Boyle both allude to incontinence of urine being produced by music, and some remarks to the same effect are made by Isaac Disraeli, while speaking of medical music in his 'Curiosities of Literature.' Shakspeare's words, through the mouth of Shylock, are these: "Some men there are love not a gaping pig; some that are mad if they behold a cat; and others when the bagpipe sings i' the nose cannot contain their urine." But what is idiosyncratic in a man appears to be natural in the horse; for horses make water more freely when whistled to. The medium through which these conditions were idiosyncratically excited in the bladder were, the nose, the skin, and the ear. Idiosyncrasies of the air passages are very common.

(13.) Dr. F. W. A. De. Fabeck, in a letter to the 'Indian Medical Gazette,' says, "I am glad to be able to assist Dr. Bird in his study of idiosyncrasies with the description of one tolerably peculiar case. 'A gentleman of my acquaintance, in excellent health, of temperate and active habits, experiences most unpleasant sensations on tasting pea-soup. I have requested him to describe, in writing, the nature of those sensations, and he gives me the following account of them: 'The feelings experienced on tasting pea-soup are exactly those of a severe cold. My head gets heavy, I sneeze frequently, and partially lose my voice. These sensations continue for about half an hour or sometimes longer, when they disappear as suddenly as they came on.' On further inquiry, I have elicited the following particulars. He is attacked with the sensations above described, although being previously ignorant that the soup he was about to partake of contained peas, and has been able to detect the presence of peas in the dried form from thus affecting him."

(14.) Mr. Roberts, surgeon, of Dudley, says, "If I remain in a room where the preparation of ipecacuanha is going on,—for instance, making the Pulv. Ipecac. Co.,—I am sure to have a regular attack of asthma. After a few seconds dyspnœa comes on in a violent degree, attended with wheezing and a great weight and anxiety about the præcordia." (Pereira's 'Materia Medica.')

(15.) A case similar to this used to be, and perhaps is now, related by Professor Christison, of Edinburgh, in the course of his lectures on Materia Medica. At any rate he related it in his course of 1852–53, the year I attended his class. He did not give names, but the narrative was to this effect: A medical man wished his son to follow the medical profession, and to become a pupil of his own, but to this the boy objected on the score that ipecacuanha always gives him a fit of the asthma. The father, evidently ignorant of this unusual action of the drug, suspected that the boy was averse to the medical profession for other reasons, and that the ipecacuanha story was merely a fiction by which he hoped to gain his end, and he resolved to test the veracity of his child. He hid away a packet of the powder in the lad's sleeping-room unknown to him. The following morning the boy came to his father to tell him that having had a fit of asthma in the night, ipecacuanha could not be the cause of his disease, and he was therefore ready to do as his father wished, and become a doctor. The father knew better, and allowed the truthful youth to select another line of life.

(16.) "A lady who suffered much from the asthma induced by the odour of hay, was in the habit of flying to Harwich in the season. On one occasion, while walking on the shore at Harwich, she was suddenly attacked by the complaint to her great surprise, as she was not aware of any [cut] grass being in the neighbourhood, but the next day she discovered that hay-making was in progress on the top of the cliff while she was walking under it. Another year, she being at Cromer, and an attack that she had suffered having quite subsided, and all the hay-making thereabouts being over, she was suddenly visited by the well-known symptoms, and on going into her bed-chamber, perceived that they were building a large stack of hay in a yard near the house, having transferred it from a field five miles distant." (Watson's 'Practice of Physic.')

Dr. Dickson, in his 'Fallacies of the Faculty,' says, "Heliotrope and the tuberose have made some men asthmatical."

### *Heart Idiosyncrasies.*

(17.) Dr. Colles writes to me, "A lady, a relation of mine, is unable not only to eat honey in any form, but to come into the same room with it without suffering an attack of faintness almost approaching to syncope." (Extract from private letter.)

Nicano, Hippocrates tells us, used to swoon at the sound of a flute; and it is asserted that many of the Sybarite women fainted on smelling a rose. Hysteria, which occasionally takes the form of a chronic syncope, has often been induced, according to Highmore, by the odour of musk. (Copland's Med. Dict. vol. ii. p. 284, ed. 1844.) The same author, in his article on syncope, says, "The odour of various flowers according to the idiosyncrasy sometimes occasions it (syncope). Fabricius Hildanus has seen it produced by the smell of vinegar; and Marcellus Donatus by soft music. The airs of their native lands have induced it in persons subject to nostalgia."

(18.) J. M. fainted twice in my presence, once at the sight of blood flowing from himself, and once at the sight of blood flowing from another. Both wounds were trifling, and the blood lost from each did not measure more than a drachm.

(19.) The following is related of Shelley by his friend Mr. Medwin: "He did not forget to visit the Prato Fiorito, a spot on the mountain, carpeted with jonquils, from which the place takes the name of the 'Meadow of Flowers.' So powerful is their odour that many persons have fainted with their excess of sweetness, and Shelley has described to me, that they were nearly producing in him the same effect."

In these cases we have instances of idiosyncratic syncope being induced through the medium of the eye, the ear, the nose, and the stomach.

### *Idiosyncrasies of the Organs of Special Sense.*

Many people are colour-blind. If a ray of sunlight, under certain conditions, be allowed to pass through a glass prism, it is resolved into its elementary constituents. On the one side, it enters the prism as a single ray of colourless light, and it emerges from the other side a rainbow. Now, most men distinguish and name the different colours of the rainbow nearly alike; but there are some who do not. One man cannot distinguish green from red; another can distinguish red, yellow and blue, but not the changing shades which connect these. A third recognizes blue only, a fourth indigo, a fifth violet, and so on. Indeed, there is no colour, simple or compound, which does not, in some instances, fail to make the impression on the retina which it usually does. Again, in other instances, different colours seem to impress the retina in the same way, and green appears red, red green, blue yellow, and so on; or it may be that all colours, according as they are bright or dull, produce those conditions in the optic nervous matter which most men recognize as black or white. The following cases illustrate to some extent these remarks:—

(20.) "M. Collardeau was an amateur artist, but the imperfection of his vision gave rise to the strangest productions. So long as he confined himself to the pencil or to sketching in one colour, he designed with much skill, but his paintings in colours were the reverse of happy. For instance, wishing to work up a scene in which he had drawn a dog, he unfortunately mistook the colour, and painted red all those parts which ought to have been deep blue. He has been known to confound on the canvas yellow with blue, and red with green, regarding his work with the complaisance of a man who felt that he had achieved success." (Cyclopædia of Anatomy and Phys., art. Sight.)

(21.) "Mr. H., a solicitor, of spare make and melancholic temperament, is frequently subject to attacks of congestion of the liver, followed by vomiting and purging of bile. These attacks are ushered in by dull pain of the head and tenderness of the eyeballs, rendering motion of them distressing. At such times he is quite incapable of distinguishing colours; all objects being simply divided into two classes, black and white, with their intermediate shades of grey. The vision of objects continues perfectly distinct, but it is not until the portal system has been relieved that the perception of colours has been recovered, and then yellow is the first distinguished. If, however, he takes five grains of calomel the attack is cut short, and the power of distinguishing colours is at once restored." (Cyclopædia of Anatomy and Phys., art. Sight.) The action of the calomel in this case and its result, show how much this so-called perception of colours depends on a condition of tissue, and, therefore, how it is a physiological and not a metaphysical question.

The conditions which modify or destroy the perceptive power may be induced and cured like other diseases. But to speak of the perceptive power being modified or changed in cases of colour-blindness, conveys a wrong impression of the real state of things. The change or modification is not in the perceptive powers, which are in the inner brain tissues, but it is in the optic nerve. This nerve is brought into contact with light in the retina, and it depends on the condition of this nerve as to whether a ray of light falling on it should make that impression which in the brain will create the secondary impression which we call green, or that other impression which in the brain creates or induces the secondary impression which we call red. The different rays of coloured light of which a colourless ray is composed, travel at the same pace, but the number of undulations by which space is got over, is greater in one ray than in another. It is greater in the yellow than in the red, it is greater still in the violet than in either. Two men travel over the same distance in the same time, but in doing the distance one man takes many more steps than the other, his steps being the shorter of the two. Now, if the retinæ in all men were the same, the ray having so many undulations to the inch which we name red, would always excite that condition of brain known as red, but the retinæ differing in temper in different people, it happens that a sharper undulation excites that condition in one which a slower undulation does in another. Professor Tyndall says, "Light travels through space at a velocity of 192,000 miles a second. Reducing this to inches, we find the number to be 12,165,120,000. Now, it is found that 39,000 waves of red light placed end to end, would make up an inch; multiply the number of inches in 192,000 miles by 39,000, we obtain the number of waves of red light in 192,000 miles; this number is 474,439,680,000,000. *All these waves enter the eye in a single second.* To produce the impression of red, the retina must be hit at this almost incredible rate. To produce the impression of violet, a still greater number of impulses is necessary."

Well, then, the number of impulses producing the impression of violet in one retina, produces yellow in another, and red in another, and this because the tone and temper of the different retinæ are different. Hence colour-blindness is but a condition of the eye tissues; and what is true of colour-blindness is true also of differences in taste, smell, hearing, and feeling. When men are different in these senses, it is because their organs of sense are different, and on this account the same external influences produce in each a different effect,—different in degree, but not in kind.

If we arrange a zinc and a copper disc in our mouth in a particular way, the current of electricity given out from this extemporized battery produces a flash of light in our eyes, and the same result is obtained if we press our eyeballs sharply with the points of our fingers. If the tip of the tongue be struck quickly and lightly with the point of the finger, sometimes an acid, and sometimes a saline taste will be produced; if its surface near its root be pressed with a clean glass rod, a bitterish taste is experienced; and a small current of air directed on the organ gives rise to a cool saline taste like that of saltpetre. These simple experiments confirm the opinion that the impression produced by any external agent takes its hue and character from the condition of the tissue impressed.

(22.) J. M., resident in Appleby, Westmoreland, could not distinguish the odour of balm (melissus) from the odour of a rose. On one occasion I gave him the balm to smell first, and on another the rose; the result was always the same. Blindfolded, he sometimes guessed right, but just as often wrong. Now he said the smell came from the rose when it came from the balm, and then he asserted the odour was that of the balm when it came from the rose. The two scents appeared to produce the same condition in his tissues of smell. This seemed to be an idiosyncrasy of kind; the following is one of degree.

(23.) Mr. Wardrop says of James Mitchell, who is deaf and blind from birth, "There were some people whom he never permitted to approach him, whilst others at once excited his interest and attention. The opinion which he formed of individuals, and the means he used to study their characters, were exceedingly interesting. In doing this, he appeared to be chiefly influenced by the impressions communicated to him by his sense of smell. When a stranger approached him, he eagerly began to touch some part of his body, commonly taking hold of the arm, which he held near his nose, and after two or three strong inspirations through his nostrils, he appeared to form a decided opinion regarding them. If this was favourable, he showed a disposition to become more intimate, examined more minutely his dress, and expressed by his countenance more or less satisfaction; but if it happened to be unfavourable, he suddenly went off to a distance with expressions of carelessness or disgust. When he was first brought to my house to have his eyes examined, he both touched and smelled several parts of my body; and the following day, whenever he found me near him, he grasped my arm, then smelled it, and immediately recognized me, which he signified to his father by touching his eyelids with the fingers of both hands, and imitating the examination of his eyes which I had formerly made." (Cycl. Anat. and Phys., art. Smell.)

(24.) "The limits of hearing are different in different persons. . . . The squeak of the bat, the sound of a cricket, even the chirrup of the common house-sparrow, are unheard by some people, who for lower sounds possess a sensitive ear. The ascent of a single note is sometimes sufficient to produce the change from sound to silence. 'The suddenness of the transition,' writes Wollaston, 'from perfect hearing to total want of perception, occasions a degree of surprise which renders an experiment of this kind with a series of small pipes, among several persons, rather amusing. It is curious to observe the change of feeling manifested by various individuals of the party in succession, as the sounds approach and pass the limits of their hearing. Those who enjoy a temporary triumph are often compelled in their turn to acknowledge to how short a distance their little superiority extends.' 'Nothing can be more surprising,' writes Sir John Herschel in reference to this subject, 'than to see two persons, neither of them deaf, the one complaining of the penetrating shrillness of a sound, while the other maintains there is no sound at all.' . . . In 'The Glaciers of the Alps,' I have referred to a case of short auditory range noticed by myself in crossing the Wengern Alp in company with a friend. The grass at each side of the path swarmed with insects, which to me rent the air with their shrill chirruping. My friend heard nothing of this, the insect music lying quite beyond the limit of audition." (Tyndall, 'On Sound,' pp. 73, 74.)

(25.) My friend Dr. David B. Smith, a few days ago, told me that once in a night-march during the mutiny, his attention was drawn to a camp-follower carrying a load, and sleeping as he marched with the column. There could be no doubt of the fact, he assured me, that the fellow slept as he walked. If touched or spoken loudly to, he roused up for a few seconds, and then fell asleep as before, but at the same time he kept his place in the column and marched along. This is an instance of comparatively perfect locomotion being carried on independently of aid or control from the higher brain-tissues; and the phenomena of locomotion therefore in this case should be regarded as the reflex action of the spinal marrow, medulla oblongata, cerebellum, and some of the cerebral ganglia, excited by certain stimuli acting through the nerves of special sense. It is therefore an idiosyncrasy, situated, as it were, in the link which connects the muscles with the nerve centres, the outward expression with the spinal and cerebral condition, the mental state with its outward manifestation. It is closely allied to skill in dancing and playing on musical instruments, in juggling and fluent talking, where the words used do not mean much; also to rapid and well-defined change in the expression of the face.

By the assistance of the above case, we cross the threshold of the senses, and enter the domain of mind and morals as it is called. This has hitherto been the property of theologians and metaphysicians; it is now rapidly passing into the possession of the physiologists, or, as they are sometimes named by their opponents, the materialists. To make simple the subject under consideration, I will state here that as far as this life and this globe are concerned, it is necessary for us to look on all mental phenomena as merely the physiological expression of our brains. I say it is necessary, for without a brain, that unseen entity, the mind, cannot operate, and we know that these phenomena take their tone and force and colour from the quality and extent of the brain tissues through which they are filtered. The lessons of disease, comparative anatomy and physiology, of the action of external agents on us, of advancing age, and of breeding, render this doctrine so secure, that the waves and winds of any adverse philosophy which is not based on experiment must fail to overturn it. It will therefore be understood, that when I give an instance of mental idiosyncrasy, I mean it to be received as an instance of cerebral idiosyncrasy, *i.e.* an unusual action of the brain tissues, as the action resulting in the phenomena of colour-blindness is an unusual action of the retina. Certain things induce through the nerves of sense certain conditions of our tissues which are agreeable or disagreeable, pleasing or painful, according to the state of the body at the time, and the intensity and volume of the impression. Many of these conditions would seem not to extend to the higher brain-tissues, and then we say we are pleased or pained, we cannot tell how; while others do extend to these tissues, and then we say we are pleased or pained by the emotions and intellectual motions stirred in us. Scents excite the former class of conditions, noble music the latter.

The motion of the tissues which in the brain excite the condition of pleasure or pain, may be limited to a small portion of tissue, as when we feel velvet, or it may, as the popular saying is, affect every fibre of our body, as for instance when we listen to music which breathes of war and noble deeds. This motion, rhythmic or otherwise, psychologists term æsthetic; since it may affect any part of, or all of, the tissues of the body, we conclude that pleasure or pain is the condition of the brain resulting from the general condition of the body, following an impression made on one or more of the nerves, and not merely an impression on the brain directly transmitted there from without, or by interior touch. These remarks are equally applicable to impressions made on the nerves of special sense, and on every tissue whose impressions are communicable to the brain, whether it be external or internal. Each one can illustrate this for himself with instances from his remembered experiences. Some sounds, smells, and sights please us, while some others displease us, or, it may be, relax our bodies with disgust. So also with the sense of touch; and the same body which is soothed and comforted by the impression of velvet, shrinks and shivers under that communicated by contact with a dead fish. Most of us like the smell of roses, and hate that of ordure, while the taste of assafœtida is disagreeable, and that of honey agreeable to most. Then while the rustle of a soft wind amongst the trees soothes us, the rasping sound given out by a saw, as it is being sharpened, produces in us a state of body extremely painful. In these instances, the higher brain-tissues, where the imagination, the intellect, and emotions reside, seem scarcely to be called into play. Idiosyncrasies of what may be termed the æsthetic or rhythmic motions of our tissues, are very common in sickness, lunacy, growing children, and pregnant women. Some of these will eat mud and chalk, others dung, others again will crave for substances which give out nauseous smells, as, for instance, valerian; while not a few will drink liquors which were previously to them disgusting, will drink greedily and until drunk. Then we all know that what pleases us one day, displeases another, that which is agreeable to us in health is disagreeable to us in disease, and that the dishes which charmed us as youth have no charm for us as old men and women. It is also remarkable that many of the people to whom I have referred above, are as *outré* in their selection of colours for wear, as they are in the selection of substances to please their noses and palates, and he who formerly approved of sober colours, will now, if permitted, array himself in all the colours of the rainbow, or probably he will show a violent partiality for a colour, say yellow, which formerly had no charms for him.

(26.) G. B. B., when an infant, was always greatly excited by anything of a bright green colour, but while recovering from a very severe illness, he transferred his partiality from green to blue. His dress must be blue, he would have blue sweetmeats, and he promised to buy the toothless baby some blue teeth.* Painting and music move us or excite a motion in us in which the higher brain-tissues participate more or less. An infant hears music or sees a picture, and, tickled by the impressions which these make on his ear or eye, we will say, he struggles in his nurse's arms and crows with pleasure. Grown into a boy, the picture not only pleases him through its colour, but it stirs his feelings and intellect through his memories. The subject of the picture excites the memories of his past experiences, and doing so in a different order than that in which these were acquired, the imagination has room for play, as I have before explained. When grown into a man, this play of the imagination covers a wider space, and embraces a greater variety and a greater number of scenes and actors, for the stores of memory have increased. As time goes on, however, the spirit of the play declines, for the motions of the tissues of middle and old age are slow, compared with those of the tissues in plastic youth; and so, notwithstanding that our experience in middle age is greater, our imagination travels less fast and covers less ground in a given time. Pictures and music move different men very differently. At the one extreme are men who can gaze on the most touching pictures, or listen to the most exquisite melody, and be no more moved by them than are stocks and stones, while at the other extreme are men whose whole being, as it were, breaks into light at their touch, as we see a phosphorescent sea break into light at the touch of the gusty wind. There are many other agencies around us which excite or mar this rhythmic motion of our bodies to our pleasure or our pain. Among these I may mention some of the elements of the aspect of a country, such as mountains and valleys, moving water, winds and clouds, lightning and thunder, extensive moors and wastes, undulating landscapes of wood, water, and cultivated crops, and so on; all of these impress us through our senses, and move us otherwise than through our memories, and different men are moved by them differently. One man likes a flat country, another a mountainous one, while this person loves the seaside, and that inland quiet, etc.

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* Of Goldsmith, Macaulay says, "He was now in his twenty-first year. It was necessary he should do something; and his education seemed to have fitted him to do nothing but to dress in gaudy colours, of which he was fond as a magpie." Sterling, in his 'Cloister Life of Charles V.,' lets us know how fond of black the emperor was. He dressed in black, the hangings of his bedchamber were black, and he delighted in ceremonies where black and green predominated.

This seems to be the proper stage to speak of idiosyncrasies in love. A beautiful woman moves many people in much the same way as a fine picture or a fine tune does. This is apparent when we watch the effect of a beautiful woman on other women who are not her rivals; but I suspect that the effect produced by a beautiful woman on most men is more or less dashed with lust. What is that state of body which we call love? It is a condition of our tissues resulting from an impression made on us by a woman. This is usually excited in the first instance through impressions made on our eyes, but it is commonly completed through impressions made also on our ears and nerves of touch. For it is known that the touch of a woman's hand and the sound of her voice aggravate the disease of love. The impressions on the senses made by a woman have different results in different men. In some they mainly affect the nobler portion of the brain tissues. They stir the nobler emotions and ambition, and through those they may 'rouse the intellect to efforts which are noble. In others they appear to awake or create an interest in music, painting, and poetry, and the love of flowers and other objects which are necessary to sensuous men; while, in a third class, they appear to excite little more than jealousy and lust. There is, I believe, a substratum of desire in every case of love. In the purest and noblest love, lust will be present in a minimum, and the intellect with the nobler emotions in a maximum. Desire, when analysed, seems to be a longing for near neighbourhood in the first instance, for contact in the second, and finally for copulation. I am of opinion that the gratification of desire is completed at different stages in different people. Then the intensity with which love moves in the tissues is very different in different men. This man goes about his love business composedly and decorously, while that storms and weeps, hopes and despairs in such a way that on-lookers say he is making a fool of himself. Again, the fluency of the motion is remarkable in some men, and its rigidity in others; this man falls in love but once in his life, and becomes a monomaniac over it, while that falls in love as often as he has an opportunity, *i.e.* with every woman he meets. The particular quality or property in a woman which leads a man to fall in love with her is, or seems to be, different in every instance. One man falls in love with her dimple, a second with the droop of her eyelid, a third with her laugh, a fourth with her walk,* and so on. Indeed, the particular movements and features in a woman which first attract and then evoke the love of men are innumerable, and this is another proof of how different men are. What excites this man's love excites that man's scorn, and what attracts this repels that. It is for this reason that we hear such remarks as, "Well, I cannot make out what So-and-so could see in So-and-so to make him marry her," etc.

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* James the Second of England was at hand when Arabella Churchill's horse fell with her, and in the course of the accident he caught

(27.) Lamb says, "I took Hazlitt to see a very pretty girl, where there were two young girls; the head and sum of the girlery were two young girls. They neither laughed nor sneered, nor giggled nor whispered, but they were young girls; and he sat and frowned blacker and blacker, indignant that there should be such things as youth and beauty, till he tore me away before supper in perfect misery, and owned that he could not bear young girls, they drove him mad." (Talfourd's 'Final Memorials of C. Lamb.')

(28.) — — was a young military man, of fair family and abundant fortune, and passed in the world for a man of average abilities and good morals. He seemed to care little for the society of women, and it was therefore with no little concern and astonishment that his relations discovered he had fallen violently in love with a woman who was twice his age, and who was so deficient in intelligence as to be considered an idiot. She also slobbered as she talked. So infatuated was this youth with this old woman, that he would sit by her for hours purring over her and wiping the slobbers from her chin. He recovered from his attack after two or three weeks' suffering, and he is now married in accordance with common taste and the wishes of his friends. The above case is to be explained in the same way as a love of assafœtida and other stinks.

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sight of the young lady's ankles. This led to her seduction, and the birth of the Duke of Brunswick, who afterwards became celebrated in the war of the Spanish succession.

(29.) Johnson (Samuel) fell in love. The object of his passion was Mrs. Elizabeth Porter, a widow, who had children as old as himself. To ordinary spectators, the lady appeared to be a short, fat woman, painted half an inch thick, dressed in gaudy colours, and fond of exhibiting provincial airs and graces which were not exactly those of the Queensberrys and Lessels. To Johnson . . . his Titty, as he called her, was the most beautiful, graceful, and accomplished of her sex. That his admiration was unfeigned, cannot be denied, for she was as poor as himself. . . . The lover continued to be under the illusions of the wedding-day till the lady died in her sixty-fourth year. On her monument he placed an inscription extolling the charms of her person and of her manners; and when, long after her decease, he had occasion to mention her, he exclaimed with a tenderness, half ludicrous, half pathetic, "Pretty creature!" (Macaulay's 'Biographies.')

(30.) The following anecdote of the same illustrious man is an idiosyncrasy in the appetite for food: it is also related by Macaulay. He says, "Even to the end of his (Johnson's) life, and even at the tables of the great, the sight of food affected him as it affects wild beasts and birds of prey. Whenever he was so fortunate as to have beside him a hare that had been kept too long, or a meat-pie made with rancid butter, he gorged himself with such violence that his veins swelled and the moisture broke out on his forehead."

Every one has, more or less, a faculty by which he arranges and squares up things, as also one which leads him to prefer one shape to another. It is partly owing to this that we have different designs, let us say, in the shapes of furniture and equipage, and in the arrangement of these. The following cases may be taken as idiosyncrasies of the tissues in which these faculties reside:—

(31.) H. B. tells me that his brother, now deceased, had the greatest antipathy to anything sharp or angular, and to such an extent did this peculiarity afflict him, that in a room he would shift about from place to place till he found one where he was tolerably distant from any angular or sharp surface. This gentleman ultimately died at Genoa of brain disease.

(32.) J. B. cannot rest in a room to which he is a stranger, until he has arranged the furniture to his liking. He squares the pictures on the wall, he puts a chair into this corner and a table into that, and he makes a general rearrangement before he is satisfied.

(33.) Samuel Johnson would conceive an unintelligible aversion to a particular alley, and perform a great circuit rather than see the hateful place. He would set his heart on touching every post in the streets through which he walked. If by any chance he missed a post, he would go back 100 yards and repair the omission.

It is to be noted that men are excited to behave in these eccentric ways by things external to them. As we have a faculty for arranging and shaping, so we have one for cleanliness. This is possessed by different people in very different degrees. The following are cases where it existed to such an extent as to constitute idiosyncrasy :—

(34.) Frederick William, father of Frederick the Great of Prussia, washed five times a day, and loved cleanliness in all things to a superstitious extent. In his hatred of dust, he would not suffer a floor carpet or even a stuffed chair, but insisted on having all of wood, where the dust might be prosecuted to destruction. (Carlyle's 'Frederick the Great,' vol. i. p. 418.)

(35.) G. B., while recovering from a severe illness at Nice, contracted the greatest dislike to dirt in every form. He was always insisting that his hands and nails were dirty, and shouting for soap and water; and this behaviour was not confined to the day, but two and three times in the night he would get up and wash himself. Did he dirty his boots in the least, they must be changed instantly, and a speck of dirt on his frock or pinafore rendered him troublesome, and sometimes furious, till the polluted garment was taken off him. As he gained strength, this little fellow lost this disagreeable peculiarity. These cases may be contrasted with that of the Afghans, who scarcely ever wash.

(36.) "Sir," said Johnson to Boswell at one of their interviews, "my poor friend Smart falls upon his knees and says his prayers in the street, and insists on people praying with him; and what of that? I'd as lief pray with Kit Smart as any one else. Rationally speaking, Sir, it is greater madness not to pray at all than to pray as Smart did. Another charge is, that he does not love clean linen; and, Sir, *I have no passion for it.*" (Forster's 'Goldsmith,' 1848.)

I give the following cases as instances where persons have been tempted to commit, or where they have committed, sin and crime through the influence of external things:—

(37.) "A lady, who was once a patient of mine, told me that every time she became pregnant, she caught herself frequently telling lies for no end or purpose whatever." (Dickson's 'Fallacies of the Faculty,' p. 158.) Men who have little control over their attention, and whose imagination is quick, always tell lies more or less; so do drunkards, so do hysterical women, so do precocious children, so do many pregnant women. From these facts it may be deduced that whenever the nervous tissues are much disturbed or in rapid motion, falsehood is as likely to prevail as truth, perhaps more likely.

(38.) "I knew a gentleman with high feelings of honour, who was occasionally in the habit, when under the influence of wine, of pocketing the silver spoons and forks within his reach." (Dickson's 'Fallacies of the Faculty,' p. 158.) Wine often makes for the time being a virtuous man a vicious, and *vice versâ*. It will change a peaceful man into a pugnacious; a modest man into a boaster, a silent man into a speaker, an honest man into a thief. *In vino veritas* may be a true maxim, *i. e.* what comes out of a man when drunk, is in him when sober; still, it is not the less true that the change in a man which allows the truth to come out is due to wine.

(39.) Casper relates the case of a married lady who shortly after her first confinement was summoned to court to answer the accusation that on several occasions she had stolen articles from goldsmiths' shops. She then confessed to her husband that during her pregnancy she had been seized with a hitherto unknown and unconquerable desire for everything bright, especially for bright articles of gold and silver; that her greatest wish was to possess them. The domestics of her house testified that very soon after the commencement of her first pregnancy she had exhibited a most remarkable alteration in her mind. She was absent, forgetful, and exhibited a most remarkable love for bright glittering articles, which she gratified in the most extraordinary manner. Thus she was, in spite of all objections, continually cleaning the household utensils of brass; she played with new bright thalers, etc., and her husband deposed that she had often complained to him, that frequently when visiting acquaintances who had bright silver or other articles, she was seized with such an inclination and desire to take them forcibly, that he must not take her there any more, for she was afraid of herself. Casper, reasoning as a lawyer, and not as a physiologist, had her condemned. (New Syd. Soc. vol. iv.)

(40.) The same author in another place says, "A man nearly connected with me, in his sixties, has, for at least twenty years, had the extraordinary notion, which continually seizes him when he uses a razor, that he should cut out both his eyes."

(41.) Speaking to the Marquis de Belleisle of a visit which the Czar Peter the Great paid to his father at Berlin, Frederick the Great said, " his many high qualities were darkened by singular cruelty. When at Berlin, going on foot, as his custom was, unattended to call on King Frederick William, the people in the streets crowded much about him. ' Brother,' said he to the king, ' your subjects are deficient in respect; order one or two of them to be hanged, it will restrain the others." During the same visit one day at Charlottenburg, the Czar after dinner stepped out on a balcony which looked into the gardens. Seeing many people assembled below, he gnashed his teeth and began giving signs of frenzy. Shifty little Catherine, who was with him, requested that a certain person down among the crowd, who had a yellow wig, should be at once put away. *This done, the Czar became quiet again.*" Some bulls become frenzied when instead of a yellow wig a man wears a red cloth. (See Carlyle's ' Frederick the Great,' vol. vi. p. 673.)

(42.) When the Czar Peter visited Magdeburg " there appeared in the audience chamber a certain serene high-pacing Duke of Mecklenburg, with his duchess; thrice unfortunate duke, of whom we shall too often hear again! who after some adventures under Charles XII. first of all, and then under the enemies of Charles, had about a year ago, after divorcing his first wife, married a niece of Peter's. Duke and duchess arrive now, by order or gracious invitation of their sovereign uncle, to accompany him in those parts; and are announced to an eager Czar, giving audience to his select Magdeburg public. At sight of which most desirable duchess and brother's daughter, how Peter started up satyr-like, clasping her in his arms, and snatching her into an inner room, with the door left ajar, and there—it is too samoeidic for human speech; and would excel belief were not the testimony so strong." (Carlyle's ' Frederick the Great,' vol. i. p. 455.)

(43.) Sir Woodbine Parish says, "Some years ago Juan Antonio Garcin, aged between thirty-five and forty, was executed for murder at Buenos Ayres. He was a person of some education, and rather remarkable for the civility and amenity of his manners; his countenance open, his disposition generous. When this *vento norte,* this peculiar north wind, set in, he appeared to lose all command over himself; and such became his irritability that during its continuance he was engaged in continual quarrels and acts of violence. Before his execution he admitted that it was the third man he had killed, besides being engaged in various fights with knives. When he arose from bed in the morning, he told Sir Woodbine's informant, he was always aware at once of its accursed influence on him; a dull headache first, then a feeling of impatience at everything about him. If he went abroad, his headache generally became worse, a heavy weight seemed to hang over his temples. He saw objects as it were through a cloud, and was hardly conscious where he went. He was fond of play; and if in such a mood, a gambling-house was in his way, he seldom resisted the temptation. Once there, a turn of ill-luck would so irritate him, that he would probably insult some one of the by-standers. If he met with any one disposed to resent his abuse, they seldom parted without bloodshed." (Mayo's 'Medical Testimony in Lunacy,' pp. 60–61.) We have here an instance of a civil, urbane, and generous-dispositioned man being turned into a murderer by a wind. Moral philosophers would do well to ponder over this case and find out its significance.

(44.) "When I am among women," writes Keats, "I have evil thoughts, malice, spleen; I cannot speak or be silent; I am full of suspicions, and therefore listen to nothing; I am in a hurry to be gone." (Monckton Milnes' 'Keats,' p. 245.)

(45.) Medwin, writing of Shelley, tells us, "So sensitive was he of external impressions, so magnetic, that I have seen him, after threading the crowd in Lung' Arno Corsos, throw himself half fainting into a chair, overpowered by the atmosphere, of evil passions, as he used to say, in that sensual and unintellectual crowd." This passage is not clearly written, and it may be read that the atmosphere of evil passions was not in Shelley himself, but outside with the crowd. The following case supports the opinion that Shelley himself felt those evil passions when jostled by a crowd:—

(46.) "B— cannot walk in a crowd without feeling a violent desire to strike and push and quarrel; and on several occasions he has got into serious disputes in consequence of indulging this propensity. He is more sensitive to the influence of a crowd at one time than another. Indeed, sometimes he has walked in crowds without being much excited, while at other times he has so distrusted himself, that rather than run the risk of walking along a crowded street, he has found his way home through lanes and back streets."

The above instances show how external influences may make liars, thieves, murderers, and fornicators of us, directly and irresistibly.

I will now give a few instances in illustration of the influence which external things exert over the cerebral lobes or, in psychological phrase, on the intellect.

(47.) I know a man who assures me he cannot compose but with a pen in his hand. He may walk up and down or sit and think, but unless he sits down with his paper before him and takes up his pen he has the greatest difficulty in expressing his thoughts. With paper before him and pen in hand, he has no difficulty at all.

(48.) "It was the custom of Sterne to be very fastidious about his dress when he wanted to go on with any of those literary performances which, though apparently so easy, were the result of labour and care. When he was ill dressed he found that his thoughts were slovenly and ill arranged." (Conolly's 'Insanity.')

(49.) Haydn used to dress himself with particular care before he sat down to composition; unless his hair was properly powdered, and he had his best coat on, he could not compose; he even used to say, if he began to write without his diamond ring on his finger, the gift of Frederick II., he could not get on, and he could not write good music on any paper except the finest. (*Id.*)

(50.) "It is related of Glück that he composed in a meadow, having his piano transplanted thither, and a bottle of champagne at his elbow. Sarti preferred the mysterious gloom of a vast apartment feebly lighted with a single lamp; and Cimarosa composed many parts of his lively opera of the 'Matrimonio Segreto' in the midst of noisy parties." (Edin. Review, May 1820, and Conolly's 'Insanity,' p. 200.) Paesullo composed, as Brindley the engineer meditated about canals, in bed; and Sacchini was not inspired, unless his favourite cats were sitting on his shoulders.

(51.) "The admirable ode to the nightingale was suggested by the continued song of the bird that in the spring of 1819 had built her nest close to the house, and which often threw Keats into a sort of trance of tranquil pleasure. One morning he took his chair from the breakfast table, placed it on the grass-plot under a plum-tree, and sat there for two or three hours with some scraps of paper in his hands. Shortly afterwards, Mr. Brown saw him thrusting these away as waste paper behind some books, and had considerable difficulty in putting together and arranging the stanzas of the ode." (Monckton Milnes' 'Keats,' p. 245.) A sister instance to this is the following:—

(52.) "In the spring he (Shelley) stopped a week or two near Leghorn, with his friends the Gisbornes, and it was on a beautiful evening, while wandering among the lanes where myrtle hedges were the bowers of the fireflies, that he heard the carolling of the skylark, which inspired one of his most beautiful poems." (Medwin's 'Life of Shelley.') How many persons there are whose brains are no more stirred by the songs of the nightingale and of the lark than are the woods and grasses!

(53.) It is related of Chatterton, that "many were the uneasinesses that his singularities caused his mother, and until he was six years and a half old she thought him to be an absolute fool, and often when correcting him told him so. But on her one day showing him an old musical manuscript, in French with illuminated capitals, to use his own words, he fell in love." These old manuscripts excited that portion of his brain which a few years subsequently produced the celebrated and harmless forgery of Rowley. (See Dix's 'Chatterton,' p. 18.)

(54.) "Alfieri mentions that his favourite season for composition was the summer. Canova is said to have felt himself unequal to the performance of a masterpiece of sculpture when he was not warmed and cheered by the sun of Italy. The celebrated Le Sage is related to have been in his latter years torpid in the morning, brilliant at noon, and languid at night, visibly acquiring each day vigour with the advancing sun, and losing it as that luminary declined. In the letters of Shenstone we find frequent expressions of his horror of winter, during which his mind and body seemed to have been equally depressed. The poet Thomson, although he described every season with such inimitable beauty, chiefly enjoyed the autumn, during which he most commonly composed. . . . Of the immortal author of 'Paradise Lost,' it is said that his time of felicitous composition was limited to the time between the autumnal equinox and the vernal." (Conolly's 'Insanity,' pp. 204–206.)

In a letter to his brother and sister, Keats says, "I have not gone on with 'Hyperion' lately, for, to tell the truth, I have not been in great cue for writing lately. *I must wait for the spring to rouse me a little.*" (Monckton Milnes' 'Keats,' p. 259.)

(55.) Shelley seems to have drawn inspiration, or, in other words, had his brain excited by the grounds around the baths of Caracalla, near Rome. "He knew all the intricate labyrinths of the ruins, and traced every narrow and ill-defined footpath that winds among their entangled wildernesses of myrtle, myrtillus and bay, and flowering laurustinus, and a thousand nameless plants sown by the wandering winds, an undecaying investiture of nature, to soften down their vast desolation. He told me he completed two more acts of his 'Prometheus.'"

(56.) Lord Bacon is said to have delighted to exercise his mind with beautiful flowers before him, and some sweet music played in an adjoining room. (Conolly's 'Insanity,' p. 213.)

(57.) It is related of the celebrated Mr. Dunning (afterwards Lord Ashburton), that whenever he wished to shine in a speech or in society, he used to put on a blister; while Curran used to prepare for exertion in a great cause by playing wild and extemporaneous airs on the violoncello.

The following may be termed the idiosyncrasies of climate and feeding:—

(58.) "Consumption appears to be all but unknown to the natives living wild in the fastnesses of this desolate region (Labrador), in tents made of spruce branches, imperfectly lined with skins, and more or less open on all sides to the external air, although they are exposed to famine and every species of hardship. But when these same natives come down to St. Lawrence to take a part in the fisheries, occupy well-built houses, and, being well paid, live in comparative luxury, most of them in the course of a year or two become consumptive and die miserably." (See Bennett 'On the Climate of South Europe,' and Professor Hind 'On Labrador.')

(59.) "There is a tract of country lying on the right bank of the Berhampooter which presents no marshy or jungle lands, such as are peculiar to the general topography of the province; but, on the contrary, possesses the appearance of a vast, open, sandy plain, bearing a short grass, only sparsely studded with trees, and free to every wind that blows. The natives inhabiting this tract of country are strong, healthy men, yet it is fatal to Europeans. The fevers developed there among European visitors are said to be of the most virulent type." (Dr. De Fabeck's letter to Editor of 'Indian Medical Gazette,' October, 1866.)

(60.) "The 'Taroos,' or wild men of the woods on the Nepaul frontier, beyond Philibeet, are capable of living and enjoying life at all seasons of the year in what we Europeans would call deadly jungle tracts. We were some years ago informed by a reliable authority that these men, when detected in cattle lifting, which is a crime common amongst them, were imprisoned in the gaol at Bareilly, which is known to be a very healthy station. Yet the Taroos died off there in great numbers, whilst they could withstand the fearful concentrated malaria, which is capable of killing Europeans almost within an hour." (Editorial, 'Indian Medical Gazette,' September, 1866.)

(61.) "The town of Martigues, in France, is almost altogether inhabited by fishermen, who have lived on fish since their infancy. Foderé, during the first year of his residence there, often prescribed meat soups to his sick, but in every instance their administration was followed by violent nausea and vomiting. They confessed it was the first time they had used any aliment prepared from meat." (Beck's 'Medical Jurisprudence,' 7th edition, p. 763.)

Most of the instances above given are of idiosyncrasy in kind; the following three are of idiosyncrasy in degree, and they will complete the collection given in this paper.

(62.) Mrs. W., wife of a foreman in the East India Railway, took two grains of calomel, and the next morning she was salivated. Two years previous to this, four grains of the same remedy were administered to her, and she was salivated for some weeks after.

(63.) Macaulay relates of the younger Pitt that he drank wine freely, "but it was very seldom that any indication of undue excess could be detected in his tones and gestures, for in truth, two bottles of port wine were little more to him than two dishes of tea." (Biography of Pitt, Encyc. Brit.)

(64.) Prof. Christison, in his fine treatise on poisons, says, "I am acquainted with a gentleman unaccustomed to the use of opium, who has taken, without injury, nearly an ounce of good laudanum . . . a dose which would certainly prove fatal to most people."

## X.

*Striking* instances of idiosyncrasy in degree are less numerous than at first thought I should have concluded them to be. I say striking instances; for instances of medicines administered in similar doses, acting more or less powerfully on the corresponding tissues of different bodies, are very common. Indeed, it is the rule that no two bodies are acted on in the same degree by the same dose of medicine; so that if we analyse and reason minutely, we may say with truth that every person is relatively idiosyncratic. Opium administered in equal quantities produces its effects in different individuals in different degrees. Now let us stretch the series of instances, and at the one extreme we have a man very sensible to the action of the drug, and at the other extreme another man very insensible to its action.

This done, let us next strike out the connecting links or instances, and these two extreme cases, when they stand alone, will seem to us to be idiosyncratic. No case of idiosyncrasy in degree can stand wholly alone, and if quality depend, as I believe it does, on fine and minute differentiation of tissue, then no idiosyncrasy in kind can stand wholly alone either. When we meet with a person in whom honey produces syncope, we are apt to exclaim, Surely this individual is like no one else; but if we extend our observations, we find that in many other persons this substance produces sensations which, if less disagreeable than those of syncope, are still not pleasant. Thus in some it causes indigestion, in others nausea, and I do not doubt but that if trouble were taken, such a series of cases might be collected as would clearly show the gradations by which the first symptom of indigestion merges in complete syncope.

## XI.

Another feature of idiosyncrasy which I must note here is this, that idiosyncratic persons are more so at one time than at another, that the condition can be acquired and lost, that it is sometimes destroyed and sometimes produced by disease, and that it is intimately connected with age—appearing in the child, it disappears in the man,—and absent in middle life, it is present in old age, etc. From this it is to be concluded that before an idiosyncratic action can be set up in any tissue, that tissue must first be prepared for such action by having undergone some differentiation.

## XII.

The most important lesson taught us by idiosyncrasy is this, that we are in all our aspects much more subject to the external world than most of us in our present ignorant state care to admit. We may name ourselves the lords of creation, and, surrounding ourselves with forms and fashions and pomps, we may strut about and assert that we can do as we will; still, this does not change the truth that the elements govern our steps, and play on us as though we were a pipe. We see a man in a yellow wig, and straightway we fall into a rage; a certain wind blows, and we commit murder; the smell of a rose makes us faint, and new-mown grass gives us the asthma. We say that we will follow the profession of medicine, but ipecacuanha is too many for us; then we say we will be painters, but we discover that our paintings are worthless, for we make our dogs red when they should be blue. Then we avoid razors in case we cut our own eyes out; and the glitter of gold and silver, for fear we should be driven to rob goldsmiths' shops. We go to dine with our neighbour, and hope to enjoy ourselves, but there is a cat in the room which violently disturbs us, or the fish makes our noses to itch intolerably, or the pea-soup gives us a cold in the head. It has hitherto been the fashion to look on idiosyncrasies as weaknesses, more or less voluntary, and on this account biographers, to exalt their heroes, have hidden their idiosyncrasies away, or when they have related them, they have done so reluctantly, and with apologies.* The science of idiosyncrasy, therefore, is scarcely instituted, and the individual instances which at present are understood, are those whose causes lie so prominently on the surface that they cannot be missed. When the science has been industriously and earnestly prosecuted, much in the behaviour of men that is now attributed to the devil working in us, or to caprice, will then be clearly traceable to the influence of some external agent, just as angry and murderous feelings are now traceable at Buenos Ayres to the influence of the *vento norte.* I am especially hopeful that the study of this will clear up much of what is obscure in hysteria, motiveless (?) crime, and moral insanity, as also that it will account for many of the now unaccountable changes in temper and behaviour in man, which many of us have to regret and mourn over. The study is divisible into two parts, that which undertakes to observe and record instances of the condition, however minute or trivial, and that which analyses the sum of the external influences to which we are subjected, and the changes to which it is liable, from change of latitude, change of season, and change of years. Here is a field large enough to give employment to every one, let him be historian, physiologist, physicist, or anything else. There is, however, this great barrier to the advancement of truth in this direction, that it is very generally supposed to be contrary to the interests of religion and of mankind, to admit that we are so moveable by the external elements, as I am trying to inculcate. But this is an assumption unsupported by either experience or reason, and to overturn it is not more dangerous to the interests of men, than it was in other days to overturn the assumption that the earth was flat, or that it was the body around which all other heavenly bodies revolved. If we are moved and played on by things external to us, (and who can deny this truth ?) surely it is better to admit this frankly to ourselves, than it is to try to hide away what cannot be hidden. Let us refuse to admit this truth, and we but prolong our ignorance; let us admit it, and we have prepared a vantage-ground for a fresh advance. For we shall then set ourselves to find out how this element, or combination of elements, moves us; and how that, as also how the action of this element, or combination of elements, may be favoured or counteracted by the action of that other element, or combination of elements. In this direction lies emancipation from our diseases, crimes, and many of the ills which afflict us, for we shall, if we but pursue the study with sufficient vigour and pertinacity, become the intelligent masters of those causes of which we are now the blind slaves. In the next section I will give a rough analysis of our surroundings, and this will lead me to the conclusion of the paper.

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* Mr. Boswell apologizes for alluding to Johnson's eccentricities and peculiarities, and pleads in extenuation that it is necessary to speak the truth. It is much to be regretted that more of our biographers had not acted like this much misunderstood, much maligned

## XIII.

In analysing our environment or surroundings, I will first speak of some of the transformations and modifications which the physical forces undergo in their intercourse with matter, and with each other; and next I will try to point out some of the leading changes which the matter of the globe also undergoes from contact with these forces. Here and there also I will endeavour to point out parenthetically, as it were, how these changes and modifications produce changes in our tissues, at the same time giving an occasional instance by way of illustration. I will do so, not in the hope of proving that we are here dealing with verified science, but in the hope that the sketch will, in the minds of many, justify me in my opinions above expressed, and that it will persuade many to enter this field of research in the belief that in an earnest study of the influence which our whole environment, in all its different modifications, exerts on the human tissues is to be found a solution of many of the difficulties and mysteries which at present surround us.

## XIV.

If from to-day the sun and stars were to cease to shine on us, almost all forms of life would disappear from the earth at no very distant date. (I say almost all forms of life, for doubtless the chemical or volcanic action of the earth, without extraneous help, would supply sufficient heat for certain forms of life for perhaps ages.) The light and heat of the sun on this account afford a good starting-point in the study of our surroundings. In the course of their journey earthwards they reach our atmosphere, where, probably, they receive their first modification.

If we let fall a pencil of sunlight on most portions of the surface of a rhombohedron of Iceland spar, it will emerge on the opposing portions of its surface, split up into two rays, each of which will display the colours of the prismatic spectrum. These spectra appear to be the same, yet they are different, and the difference is proved in this way. If we take a second crystal similarly shaped to the first, of Iceland spar, and let fall these two secondary rays on the surface corresponding to the surface in the first crystal on which the primary ray fell, then it is seen that these secondary rays are further separated from each other. But if, instead of applying the crystal in the same way, we reverse it, then the result is this, that the two secondary rays, instead of receding from each other, approach each other, and, coalescing, form a single ray similar to the primary ray from which they both originated. It appears from this, that the secondary rays have different relations to the two halves of the second crystal, so that the right half of the crystal in its reversed position attracts the left-hand ray, and the left of the crystal the right-hand ray. The differences in these relations indicate the difference in the physical properties of the secondary rays. It is this acquisition of fresh properties by light when it is polarized, which makes the polarization of light so interesting a study to the physiologist, for if an inanimate crystal becomes sensible to these changes, it can scarcely be otherwise than that the living tissues are sensible to the same. Well, then, what the crystal of Iceland spar does for the pencil of sunlight, the atmosphere of our globe does for a large portion of the sunlight which reaches it. It polarizes it, or, in other words, endows it with fresh properties.

The atmosphere also disperses the sunlight. If we throw a ray of light on a mirror in a darkened room, it is reflected; the ray remains a ray. But if we throw another ray on a sheet of white paper in the same darkened room, the light becomes dispersed and is spread over the room; and the room, instead of being light only where the reflected ray falls, grows uniformly light all over. By means of this property of the atmosphere, the sunlight is tempered, and the sky appears blue. The sky has not the same polarizing and dispersing power at all times, it must therefore be considered an agent of differentiation through its polarizing and dispersing properties. When the sun's rays reach the earth, they act on and change everything on which they fall, at the same time that they are changed themselves. The changes which light undergoes in its contact and intercourse with the matter of the globe are very numerous. Some are known, others are partially known, most are yet unknown. It is analysed by absorption. Objects depend for their characteristic colours on their absorbing properties. A green object absorbs the red elements and reflects the blue and yellow, and so appears green. A red object absorbs the blue and yellow, and reflects the red. From this it is easily understood that the sunlight reflected from a green wood is not the same as that reflected from a brown or autumnal wood, and that it has a different action on our tissues. A brown wood in most people excites sadness and regret, a green one hope and joyous anticipations. The colour of trees and shrubs, ought always to be considered in laying out gardens and grounds. Light, like sound, travels in waves, and the wave is shorter or longer in the different rays according to their colours and refrangibilities. Now, the relative positions of the waves of one ray to those of another have much to do with the modifications of sunlight. When the rhythm of the waves is interfered with by matter in one direction, it is equally interfered with by the same in another direction, and the two opposite interferences neutralizing each other, no change in the sunlight is apparent. But there are other instances where the interference being as it were one-sided, the change in the light becomes visible, and the process of 'interference' is illustrated in the colours of mother-o'-pearl, the iridescent plumage of some birds, and in the iridescence of sandy plains, especially when the sand is largely mixed with salt.

Sunlight is extensively polarized on the surface of the globe. No pencil of sunlight that falls on the surface of the sea, on rivers, lakes, and the shiny leaves of plants, but is more or less polarized by reflection, and, as polarization, as we have seen, gives new properties to light, it follows that these substances change the relations of light to the tissues of our bodies. A ray of sunlight, when analysed, is found to be composed of red, blue, and yellow rays, and of rays intermediate in colour to these, also of chemical rays which lie to the right of the violet in the coloured spectrum, and of heat rays which lie to the left of the red rays in the same. Now light in its constitution is changed by every substance on which it falls; but as each substance changes it differently, it follows that the general result will be different when the substances on which it falls are different; the general result will commonly be different in different localities, for the obvious reason that no two localities are altogether alike.

The substance which changes it least is rock salt, this substance being pervious to almost the whole of the elementary rays, whether they are heat, coloured, or chemical rays.

Melloni, by transmitting light through a series of screens made of different materials, sifted light of all its heat, just as the moon sifts the sunlight of the greater portion of its heat and then transmits it onwards as moonlight. Some transparent media arrest the blue rays, others the red, others the yellow. Others, again, have a very wonderful power over the chemical rays. If a solution of sulphate of quinine be daubed over the screen to the right of the coloured spectrum where the invisible chemical rays lie, the wetted places become luminous. A preparation of the green colouring matter of leaves and certain other substances have the same property. This phenomenon is termed fluorescence.

Heat like light is acted on by, and acts on, all substances. Like light also it can be radiated, reflected, and refracted. That which comes from the sun is radiated from the sun, the heat of a fire is reflected from the inside of a clean Dutch-oven on the dish, and the rays which light a piece of rag through the medium of a burning-glass are refracted. All substances have the power of absorbing heat and of radiating it again; good absorbers are good radiators. One of the most powerful absorbers of heat is aqueous vapour. A moist atmosphere absorbs more heat than a dry one. On this account, a desert, where the atmosphere is generally dry, is hot in the day and cold at night.

Clouds act as refractors occasionally. I have seen a regiment of British infantry violently sunburnt from exposure on a cloudy day in the month of October; sunburnt and the majority of the men also seized with coryza. If a pint of water at 40° is added to a pint of water at 100°, the mixed fluid will stand at a temperature of 70°, which is the mean temperature of the two. But if a pint of water at 40° be mixed with a pint of mercury at 100°, the mean temperature of the two will be 60°; and if a pint of mercury at 40° is mixed with a pint of water at 100°, the mean temperature will be 80°. From these experiments it is plain that different substances have different stores of heat, and different capacities for storing away heat which are not measured by the thermometer. The practical bearing of this fact on our tissues is obvious, for different localities will grow warmer, quicker or slower, beneath the morning sun, according to the aggregate powers of the substances composing them to hide away heat. The rarer a substance becomes, the greater is its capacity for storing heat. This fact enables us to explain the gradually diminishing temperature which we experience as we ascend mountains. For the same reason our skins are cooled by the evaporation of our sweat, and the atmosphere by evaporation from seas and lakes and rivers. Heat thus stored is named specific heat. Closely allied to this heat is the heat named latent heat. The water in which ice melts does not rise above 32° until the whole is melted, and this, notwithstanding that the surrounding temperature may be much higher than 32°. Again, a pound of water at 212°, mixed with a pound of water at 32°, gives two pounds of water at 122°; but a pound of ice at 32° mixed with a pound of water at 212° gives two pounds of water at 51°, so that 142° have disappeared or become latent. Water may, therefore, be regarded as ice in combination with a certain quantity of heat. If now these two pounds of water be exposed in an atmosphere, say of zero, its temperature will fall to 32° *and remain stationary at that* until the whole is frozen, when the frozen mass will also fall to zero. The freezing mass remained at 32° until it became a frozen mass because of the heat latent in it. But for this behaviour of heat and water the cold of winter in many countries would be so intense as to be injurious to life; and in summer the thaw of ice and snow would be so rapid as to admit of the formation of ruinous floods. (Miller's 'Chemical Physics.') Certain substances when dissolved in water interfere with the freezing of it. The salts in lakes and soils therefore become an element in our calculations as to whether this or that locality is healthy or otherwise; for a soil which contains salt that interferes with the freezing of its water must necessarily assist in rendering that locality colder in winter. Here is another instance of how all things are woven together. The heat of the sun or from any other source, when it has been once absorbed, loses some of the peculiarities of its original source when it is radiated again; or, in other words, heat as it passes through substances becomes modified; each substance giving a modification more or less peculiar to itself. The following experiment is a familiar illustration of this:—"A jet of mixed oxygen and hydrogen gases furnishes a heat nearly as intense as any which art can command, yet it does not emit rays which have the power of traversing glass in any considerable quantity, even though a lens be employed for their concentration. Upon introducing a cylinder of lime into the jet of burning gases, though the amount of heat is not thus increased, the light becomes too bright for the unprotected eye to endure, and the thermic rays acquire the property of traversing glass, as is shown by their action on a thermometer, the bulb of which is placed in the focus of the lens." This experiment shows the influence which substances have to change light as well as heat, for the light when the lime is placed in it becomes much more brilliant. Now this property of substances, fairly comprehended, is a very startling one when we come to reflect on it. We are apt to read the sentence which records the truth, and to pass it by as one of little moment, but what it really amounts to seems to be this; that the rays of heat which reach us from the sun, immediately they touch the earth, change from what they mingle with, and are transformed into thousands, it may be millions, of modifications, each of which possesses different properties: this one can traverse glass, that one cannot; this one can get through lamp-black more easily than that one, and so on. In this way trees and grasses, iron soils and clay soils, a rocky country and a mouldy country, chalky formations and coal formations, sandy plains and grassy plains, have heats and combinations of heats peculiar to themselves. The wonder is, not that men in different countries differ in appearance and diseases, but that they so closely resemble each other. This seems to be the proper place to introduce the following case illustrative of the different effects which the different lights and heats have on the tissues. It was sent to me by Dr. Fawcus, of Alipore.

Case of Mr. R. H. Dobson, Deputy Superintendent of the Alipore Jail. "About a year ago he mentioned to me that he was subject to severe colds in the head, and I had myself noticed that he often could scarcely speak for sneezing. The attacks of coryza at first came on about once a fortnight, then once a week, and latterly every two or three days. They sometimes commenced in the morning, and sometimes in the evening, and their duration varied from four hours to more than a day. Various remedies such as quinine, arsenic, sal volatile, opium, were tried without effect. His general health did not suffer in the least; the attacks always subsided suddenly, and then he felt quite well. Mr. D. noticed that they came on frequently after getting his feet wet, he therefore took to wearing goloshes, and this for a time seemed to have cured him, but his exemption did not last long. Then he determined to try the effect of a change of air, and he went for a month's voyage to the Andamans and Burmah, but returned to Calcutta no better. About two months ago he met a gentleman at one of the livery stables in Calcutta who recommended him to wear coloured spectacles. He mentioned this to me, and the suggestion seemed so reasonable that I strongly advised him to make the experiment. He did so, and now for upwards of two months he has been almost free from coryza." I have subsequently learned from Dr. Fawcus that the spectacles which Mr. Dobson wears are of a smoky neutral tint.

Professor Tyndall, in a series of experiments, has proved that different gases have very different powers to absorb heat. Thus for one ray of heat absorbed by dry air at one inch tension, he found that ammonia at the same tension absorbed 7260 rays, and sulphurous acid 8800 rays.*

These experiments indicate at least one property of the exhalations with which in our daily business we come in contact, for it is to be concluded that every odour good or bad, for instance, which mixes with the atmosphere increases or decreases the amount of heat which that absorbs. The scents of flowers consequently have a place among the elements which constitute our surroundings; so has the smell of a dunghill.

*Electricity.*—In thunderstorms milk has a tendency to become sour, and eggs and meat to rot. An atmosphere proved by other phenomena to be highly charged with electricity, produces in many persons sensations resembling those of slight incipient fever; vague alternations of chill and warmth on the skin, general languor of the frame, debility and aching of the limbs, oppression or other uneasiness about the head. (Holland's 'Essays.') "In a paper read before the Royal Society in 1836 on the ventilation of the Custom House of London, Dr. Ure states the peculiarities of atmosphere in the long room warmed with hot air, and where 200 persons are always present, to be its extreme dryness and its negative electrical state; the general effects produced being vertigo, with a sense of fulness and tension about the head, a quick but feeble pulse, and deficient circulation in the lower extremities." (*Idem.*) From these instances it appears that the electricity of the atmosphere has a direct action on our tissues when applied in minor degrees; applied to our bodies in a major degree as in lightning it kills us outright, and in doing so it destroys the contractility of our muscles, and that property which our blood possesses in most instances of coagulating after death. Whatever therefore increases or lessens the amount of electricity in the atmosphere, or changes the relative proportion of its negative to its positive components, influences in some way our tissues.

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* Does this explain the power of ammonia to subdue heat in fever?

All chemical action gives rise to electricity, and Faraday says that the chemical action of a grain of water on four grains of zinc can evolve a quantity of electricity equal to that of a powerful flash of lightning. As chemical action is daily going on to a vast extent in trees, and in all kinds of vegetation and in animals, a large proportion of the atmospheric electricity must come from this source. When water is evaporated from salt, electricity is evolved just as the salt begins to dry and crepitate; it is almost certain therefore that a large evolution of electricity takes place when showers of rain dry off salt plains, such as those of the Pacific Coast in North America and in Central Asia; the great desert of Gobi, Utah, etc. An insulated boiler from which steam is allowed to blow off at high pressure through long tubes in which partial condensation of the steam occurs, furnishes us in the hydro-electric machine of Armstrong an admirable source of high electric power. The electricity here is produced by the friction of the rush of steam on the orifice, and the roughest orifice produces the most electricity,—a wooden orifice much more than an ivory one. The experiment enables us to understand how the rush of a moist wind over rocks and sandy plains, through bending woods and waving cornfields should also, by means of friction, contribute a considerable share to the total amount of atmospheric electricity. And on the same principle the dashing of the sea on a rocky coast, and many other natural motions where friction is produced, must have a similar result. The electricity produced from these sources is positive, and being so, is the normal electricity of the atmosphere. During thunderstorms, however, the electrical state frequently becomes negative. Sir John Herschel thinks that the cause of this may be the rubbing of the rain-drops against the air as they fall, for Faraday has shown that the friction of water-drops, when pure, against all substances, developes negative electricity in the substance rubbed, and the spray of a waterfall fills the air around with negative electricity. With these statements before us, it is not difficult to understand how the natural motions of one locality are more favourable to the production of electricity than are the natural motions of another locality, and being so, how one locality, through the medium of its electricity, has a different action on our tissues than another locality has.

*Chemical Action* means a fresh arrangement of the particles of matter. This is going on to a prodigious extent in and on the earth. It is one of the leading actions in the growth of animals and vegetables, and in the decay of these. Soils are also being continually acted on by the oxygen and carbonic acid of the atmosphere, and volcanic motion is chiefly to be attributed to chemical action in the interior of the earth. Then the other forces may all take their rise from chemical action. It directly originates heat, light, and electricity, and indirectly it can produce magnetism. It is consequently a mother of those agents and agencies through which changes in our surroundings are worked out that are powerful to change the condition of our tissues.

*Magnetism.*—This force in its behaviour with matter resembles electricity in many particulars. Human attention was first drawn to it by the property which an iron ore found in Magnesia possessed of attracting iron. Substances which have this property are named magnets. All magnets have two powers, one of attracting certain substances, the other of repelling certain other substances. The substances attracted are spoken of as magnetic, those that are repelled as diamagnetic. When iron is touched in certain ways with a magnet it becomes a magnet itself. This communicated property seems to establish closer relations between the giving and receiving substances, and so a magnetized needle comes to have those sensitive relations to the globe, in virtue of which sailors are enabled to navigate the seas. The earth, from the influence which it exerts on the needle, is regarded as a huge magnet.

Electricity and magnetism can be generated from each other. For instance, " if a thin wire of copper, or any other non-magnetic metal be employed to complete the voltaic circuit, such a wire will for the time attract iron filings, and the filings will be arranged in a layer of uniform thickness around the whole circumference of the wire and around its whole length. The moment that the connection with the battery is broken, the magnetism ceases and the filings fall off; but the attractive power may be again instantly renewed on completing the circuit."

Let the extremities of a helix of copper wire be connected by means of wires several feet in length with the two ends of the galvanometer, so that the needles shall be beyond the direct influence of the magnetic wires to be employed. Motion of a permanent magnet across the coils of the helix, instantly produces a current of electricity in the wire. From these two experiments it appears that the action of electricity and magnetism on certain substances disposed in certain directions produce each other, and they render it intelligible that in the economy of things it is probable these two forces are, in their action on the matters of the globe, continually being transmuted into each other;

chemical action going on in the crust and in the bowels of the earth being the mother of both. If this be true, then the transmutation is at the same time continually giving new properties to the matters in which the transmutations take place; and these matters by the acquisition of these new properties are ever assuming new relations to the tissues of our bodies.

Terrestrial magnetism is said to have three elements (Sabine's article on the subject in Keith Johnstone's 'Physical Atlas'), viz. of declination, dip, and intensity. When the needle does not point due north and south, but a little to the east or the west, it is said to decline. When one point of the *horizontal* needle dips *vertically*, the needle is said to dip. If a needle, when it is being magnetized, be made to vibrate, it will assume different magnetic relations, to what it will possess if it be not vibrated. By an application of these truths, the intensity of the magnetism of the earth can be measured, and it is found to vary at different points of the earth's surface. Generally speaking, the places where the decline, the dip, and intensity are greatest or least, do not correspond: they are greatest near the poles, and least near the equator. Now, what is remarkable and most important to the physiologist, the places of maxima and minima of these three elements are liable to three kinds of change. They change daily, and this is probably to be attributed to the diurnal rotation of the earth; the sun now shining on *this* surface of the globe evokes the phenomena of life in countless variety, darkness covering *that* lulls the excited motion into rest. They change periodically with the seasons; these changes are probably to be attributed to the change in the relative position and posture of the earth and sun; as the former travels along its orbit, the motions of the globe being more lively in the north when the sun is north, and in the south when the sun is south. They change secularly, *i.e.* certain changes in the magnetic phenomena go on progressively for long periods of time, but the laws of which are still unknown. These are probably owing to bodies outside our planetary system. The sun not being a fixed point, but travelling in space with his various planets revolving round him, as the earth travels with the moon revolving round her, it follows that the relations of our planetary system to the rest of the universe are continually changing. To these changes in our planetary relations will probably in time be traced many of the secular changes in terrestrial magnetism.

Magnetic storms are indicated by sudden and considerable disturbances of the magnetic instruments of short duration, which are produced by some widely acting causes; as these disturbances have been noticed simultaneously at very distant points of the earth's surface. These storms are due, probably, to some sudden molecular action in the sun. "Mr. Carrington was watching a large spot on the sun on the 1st September, 1859, when suddenly he saw, at 11.20 A.M., a bright spot in the middle of the dark one; this appearance lasted for about ten minutes, and a corresponding disturbance in time and duration was indicated by the self-registering magnetometer at Kew." (Miller's Chem. Physics.) Sabine has pointed out that the maxima and minima of the apparent spots on the sun's disc, as tabulated by Schwabe, correspond with the storms and lulls of the magnetism of the earth.

These spots on the sun, whatsoever their cause, are interesting to the physiologist on account of their being the power or the medium through which changes are introduced into the magnetism of the globe on which we walk, or, more correctly speaking, out of which we grow. The direct action of magnetism on the human tissues is inferred rather than proved. Its indirect action is proved through its influence on the other forces which are known to have a direct action on us, as for instance electricity and light. Flesh has been proved by experiment to have diamagnetic properties; but independent of experimental proof, it is reasonable for us to conclude that the force which by its action on the magnetized needle enables the mariner to steer his course with almost absolute certainty across the trackless seas is not inoperative on a thing so sensitive as the living body. The following experiment is described by Mr. Tyndall in his book on 'Heat.' Between the poles of a temporary magnet of great size, he by suitable machinery caused a cylinder of copper, filled with an alloy more fusible than copper, to revolve. When the iron was magnetic from the current of electricity transmitted through it, the cylinder gave to the hand the feeling as though it were being turned in butter. When the current was stopped, and the iron for the time being ceased to be a magnet, the cylinder, when revolved, gave to the hand the feeling of being turned in air. When the current was again turned on, and the cylinder violently whirled in the empty space between the magnetic poles, it (the cylinder) grew hotter and still hotter as if from friction, till at last the fusible core melted and ran out. It is pertinent to ask, what would be the result if, instead of a copper cylinder, a living body were to be whirled between the poles of a magnet sufficiently large and strong. The body is not a copper cylinder, but it contains iron and other substances which are very sensitive to magnetism. When we have brooded over the marvels of this experiment, we are slow to condemn the least marvellous tales of mesmerists and electro-biologists as the concoctions of impostors.

These remarks are enough to show how liable the physical forces are to be modified at the touch of matter. The sunlight mixes with the tissues of trees, and becoming chemical action enables them to decompose carbonic acid, whereby they grow. The atmosphere polarizes it, and causes to take sides. This substance steals its red rays, that its blue, and this other its yellow. The rhythm of its motion is interfered with in a particular way, and straightway it breaks into beautiful colours on the plumage of peacocks and parrots. It enters colourless on one side of a crystal, and on the other comes out a rainbow. It mixes with burning gold or soda, or with many other substances which are not burning, and leaves these stamped with the patterns peculiar to each, by which, when it is thrown upon a screen, millions of miles away, we recognize where it has been. Nor are the modifications of heat less prodigious. By every substance it is absorbed, and by every substance it is radiated; but the heat radiated is never the same as that absorbed, for it has changed from the touch of the medium through which it has filtered. (Melloni's 'Researches on Radiant Heat.') In this way its modifications and combinations of modifications are innumerable, and when we consider that modification means the acquisition of fresh properties, we begin to understand how it is that many changes take place in it, which the thermometer cannot measure; and how the heat of one wind acts differently from the heat of another wind; or how people should exclaim, How depressing this wind, and how exhilarating that!

These changes may be spoken of as the changes of composition; the form and structure of things also influence the behaviour of the forces. Coulomb discovered by a series of simple experiments that the distribution of electricity amongst neighbouring bodies is much influenced by their size and shape. If a series of electrified balls be placed in a row, and if the balls gradually diminish in size, say from left to right, the greatest accumulation will be in the small ball at the right, and if gradually diminishing balls be added to the right, a discharge will at last take place, the smallest ball as it were being unable to bear the force of the accumulation. The science of the relation which the shape of things bears to every other force besides electricity, is still in its beginning, but when prosecuted it cannot fail to give some insight into why, for instance, the organs of our bodies assume the shapes they do,—why a liver is liver-shaped, a heart heart-shaped, and a brain brain-shaped. Crystals are divided into regular and irregular, according to their planes of crystallization. Now if we take a regular crystal and heat it, we find that the heat travels through it at an equal rate in every direction. If we take an irregular crystal and cut a slice from it at right angles to its axis, and a second slice longitudinally or parallel to its axis, and having covered these with wax, if we insert a red-hot wire into a hole perforated in the centre of each for the purpose,—we shall find that the wax melts in the form of a circle in the transverse slice, and in the form of an ellipse in the longitudinal slice.

Here is another instance bearing in the same direction. Phosphorus and sulphur exist in three forms, which are easily transmutable the one into the other, yet these have different powers of transmitting light and of storing away heat. (See Professor Graham, 'On Colloids.')

In addition to being modified by objects according to their composition, form, and structure, the forces are modified by each other. The following instances show this:—If the temperature of a piece of iron be raised to redness, it will become indifferent to the presence of the magnetic needle, and it will cease to be so when it again grows cool. Here heat controls the magnetic force. Simple ignition of charcoal gives out a comparatively feeble light, while the same ignited in the electric circuit gives out a light of wonderful brilliancy, which is named the electric light. This is an instance of the power of electricity over light.* If a current of electricity be sent through a platinum wire of sufficient power to raise it to a dull red heat, then while it is in this state, if we ignite a loop of it in the flame of a spirit-lamp, the other portions of the wire, not so ignited, will begin to cool. In this experiment heat interferes with and controls the flow of electricity.

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* I dare say the advance of science will explain this phenomenon by

Our surroundings in any living locality depend largely for their characteristics on the amount of heat and light received from the sun, and on the presence of a certain quantity of water. Indeed, without heat and water, life, *i. e.* organized life, would be impossible; with a sufficiency of heat, light, and water, most localities can sustain numerous forms of life, which, as we have seen above, react on the forces which excited their growth and development. And as the kind and amount of life present in any locality also very largely depend on the quantities of these agents acting in the locality, the means which increase or diminish their amounts are also means for the modification of life and the differentiation of tissue, and consequently important elements in the sum of our surroundings. I will allude to a few of the more important of these.

The amount of heat and light received from the sun by a locality, depends on the angle at which it is hit by these forces: the more oblique the angle, the less heat and light are received, and the more rectangular the angle, the more heat and light are received. The poles have a six months' day and a six months' night, and within the tropics the days and nights are of equal length all the year round; consequently the sun shines in the year as long on the poles

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attributing the brilliancy of the light to some peculiar molecular action set up in the charcoal by the electricity,—some molecular action akin to that which Professor Thompson says is set up in the glass when light is changed by magnetism in one of Faraday's most celebrated experiments.

as it does on the equator; but the amount of heat received by the earth at the equator is much greater than that which it receives at the poles, *i.e.* in proportion to its surface. This is because the rays fall obliquely on the poles and vertically on the equator. The angle of heat and light at any one spot keeps varying all the year round. It does so from the motion of the earth along its orbit: the motion of the earth along its orbit affects the distribution of light and heat to any locality in a very great degree; and perhaps more so than any other cause. As we know, it gives rise to the seasons, with those phases of life which are characteristic of them. To any one sceptical of the influence of the so-called external world over organized beings, it will always be beneficial to point out that the bloom of summer and the nakedness of winter are merely the consequences of the increase and the diminution of the light and heat.

*Elevation and Depression of the Crust of the Earth.*—The mean annual temperature of Florence is lower than that of Nice, and this notwithstanding that of the two cities, Florence is the nearer to the equator. The high temperature of Nice and its sister Sanitaria Mentone and San Remo, is mainly, if not entirely, owing to the shelter from the northerly winds which they receive from the maritime Alps. Again, the desert of the great Gobi in Central Asia is a desert for want of water. The southern breezes, laden with the moisture of the southern seas, blow up the slopes of the Himalayas; but before they can cross the crests of these mountains and enter Thibet, they have been drained of their moisture by the cold of high elevations. This moisture is precipitated in rain and snow, which go to feed the rivers of the plains. Were the Himalayas to sink to half their present height, the great Gobi would cease to be a desert.

Elevation of the earth's crust results in continents and islands, as well as in the mountains which may belong to those.

Continents may be regarded as large islands, or islands as small continents. Continents are warmer in summer and colder in winter than islands are. The reason of this is, that their extent of coast being small in proportion to their extent of surface as compared with islands, they have not that abundant supply of moisture in their atmosphere and around them which, as we have seen, conduces to an equable temperature.

Heat is conveyed from one portion to another of the earth's surface by water and watery vapour. Thus the great Gulf Stream, which, after striking the southern shores of the United States, washes the western shores of Ireland and Britain, raises, it is said, our mean annual temperature some degrees. Were an island to appear in the West Indian seas so situated as to direct this stream south instead of north, as now, then the climate of our islands would necessarily become more severe. Again, the mean annual temperature of the northern hemisphere is higher than the mean annual temperature of the southern hemisphere, and this is owing to the transfer of heat from the latter to the former by means of vapour. The expanse of sea is much greater in the south than it is in the north, hence the evaporation from southern seas is greater than it is from northern seas; but, as the continents of the north are more extensive than are those of the south, the means of condensing vapour into rain are greater in the north than in the south, and the fall of rain is consequently greater in the north than in the south. Now, the surplus vapour of the south, when the sun proceeds north, follows it on, as it were, the backs of the trade-winds with its store of heat, and it gives up this latter when it, impinging on the northern continents, is condensed by the variable surface of those into rain and snow. All lakes, therefore, on the same principle, whose waters suffer evaporation, and whose vapours are borne away by the winds to a colder atmosphere to be condensed, are means of equalizing heat on the surface of the globe. An easterly wind in Europe is a colder wind than a southerly or westerly one. This is chiefly owing to its passing over the continent of Asia, where it finds but little water to steal, and consequently but small means of carrying heat along with it. Another of the chief tangible elements of our surroundings, is the constitution of the soil on which we walk. This influences our tissues directly, for our condition in a large measure depends on the ease with which we can extract a living and our comforts from the ground. It also affects us indirectly, and we understand this when we learn that some soils, as Brazil, produce vegetation abundantly, and others, as the southern steppes of Russia,* scarcely at all; and when we reflect that a bare country exerts a different influence over us from what a wooded country does. Further, as different substances modify heat and light differently, it follows that soils differently constituted have different indirect actions on us through the different modifications which they introduce into the heat and light that surround us. Thus soils containing iron in an unusual proportion are thought by Dr. Martin and others to conduce to the so-called malarious diseases.

These primary elements of life being mixed in very different proportions in different localities, we have different climates and different phases of life characteristic of those which cannot altogether be attributed to latitude. It is on account of this unequal moisture that isothermal lines travel in a wavy instead of a straight direction round the globe. According to the amount of the elements of life, and the proportions in which they are mixed, existence for vegetables and animals will be easy or difficult. On the same depend many* of the differences in species, and in the width of zone in which each individual can live and thrive. As a rule, vegetables inhabit narrower zones than the lower animals and men do. The reason of this is, that the lower animals and man have some control over, or can protect themselves against, external influences, whereas vegetables are unable to exercise these powers. A tree must endure or fall before the blast, whereas a fox shelters himself in a hole; and a man not only shelters himself in a hole, but covers himself with warm clothing, surrounds himself with comforts, such as fires and carpets, and sustains his struggling powers with suitable food and drink. In the tropics, the antagonism between life and external influences is less violent and abrupt than it is in the temperate latitudes; but at the same time tropical countries produce less noble individuals of those forms of life which are common to both. From this it appears that while too much rub and friction lead to death, a certain amount of these is required for the elevation of organized tissues. Trees, which have endured the wind and sun and rain, yield better wood than trees which have been grown in sheltered places. So with man, for almost all *really great* men have been born of stocks which have fought with difficulties and buffeted with misfortune. Men and horses, sheep and cows, are all less noble in the tropics than they are in more temperate regions, where to live is more difficult.

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* These produce abundant grass, but scarcely any trees, the subsoil being unsuited for the growth of trees.

The, what may be termed, secondary elements in our surroundings, are the various forms of organized life which cover the earth, vegetables and animals. Of the former, trees are the most important, and I will here enumerate a few of the differences which trees are capable of introducing into a locality.

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* I say many, and not all, for there is always the element of emigration to be considered in this question.

(*a*.) They render its atmosphere more uniformly moist. They do so partly by extracting moisture from the winds as they pass by; and partly by hindering the sun and winds from taking away that which they already possess. By means of the cool, which is the result of the evaporation from the multiplied surface of the foliage, they temper the hotter winds which are passing over them, and so induce them to part with a portion of their wet; and every one who has lived in an English country home knows that the summer shower hangs about the grass and flowers of the woods long after it has been dried from the grass and flowers of the neighbouring fields.

(*b*.) By rendering the atmosphere more uniformly moist, they temper the heat and cold of the different seasons.

(*c*.) They cause the rainfall to be distributed more equally in time throughout the year. They bring down the atmospheric moisture in more frequent and gentle showers; whereas in a country denuded of wood, this goes on increasing, until, from electrical and other causes, it is precipitated in, as it were, floods to the accompaniment of winds and lightning. These floods joining together, rush down the slopes, and inundating the plains, pour themselves into the sea. This is what happens not unfrequently in the south of France now, as in recent times most of the Northern Pyrenees have been stripped of trees.

(*d*.) Trees, by inducing frequent and prolonged gentle showers, economize the water of a country, and so make it more available for existing vegetation, and for its future extension.

(*e*.) As we have seen, they, by chemical action, and by friction against each other and the winds, add to the atmospheric electricity, and they modify sunlight. They rob it of most of its chemical, and many of its coloured rays, and then reflect it, thus softened, upon surrounding objects.

This change which trees work on sunlight is known to him who, having toiled for hours over a sandy plain under a tropical sun, suddenly finds himself on the outskirts of a green wood. They, by absorbing and radiating heat, modify it, and give it new properties, in virtue of which it acts differently on us from what it does when it falls directly on us from the sun.

(*f.*) Trees, by their chemical action on the air, and on the ground in which they grow, prepare a soil for plants which require a richer food, but which are more useful to man in his daily life.*

*Men.*—The society of our fellows is necessary for our welfare, as the history of Alexander Selkirk and of solitary confinement in America, plainly show; and yet man is the greatest enemy of man. When our neighbours please us, and our interests do not clash sufficiently to interrupt our pleasure, then we are friends; and we dwell together in peace and amity. But when they cease to please us, and

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* "But I have also discovered another very important fact, and that is, that villages out in the open plain suffer far more from cholera, and the disease is more deadly there than in villages which are well-wooded. Further, that if I were to select a strip of the division of any given length, but of say sixty miles in breadth, namely, thirty miles in the plain, and thirty miles of jungle, let the jungle be stunted and sparse near the plain, and let the foliage increase and become more dense until the edge of the strip shall be thick forest; and then if I march to each edge of the strip in acute zigzags, I shall find that at the centre of the strip, namely, where the jungle and plain join, cholera only occasionally visits the villages there, say once every three or four years or so, and the deaths are comparatively few,—the further I progress into the denser foliage, the more rare the visitations of cholera seem to be, until at last I find that among the inhabitants of the villages in the forests, the disease is scarcely known, and yet one would have supposed that these, of all people, would have been its most likely victims, for they live upon the poorest of food, green jungle berries and roots, and are badly housed and ill clad.

"Again, if I turn towards the plain, I shall find, on emerging from when our interests clash much and cross each other, then they become our enemies, and forgetful of fine precepts, we go to war and butcher each other. Men therefore form a very principal element in our surroundings. In our mutual struggle for life and position, we invent, discover, and write books; and human friction is the best patron, and the best advancer of human knowledge. In addition to these effects of man on man, men influence us in other ways. They radiate heat on us, and this means that they give us heat altered in properties ; they affect us by means of their shapes and colours, and perhaps they emit on us certain modifications of force which produce in us the phenomena of electrobiology. To the radiation of heat, those emanations of force, and perhaps also to certain forces generated by friction, the one man against the other, is to be attributed the effect which mixing in a crowd produced on the supersensitive Shelley, an effect which has been described above. Then there is the influence which the one sex exerts on the other. If we take a series of plates of copper and zinc, and having arranged them alternately, if we dip them into distilled water, electricity will be produced in quantities sufficient to charge Leyden jars. Now, shall it be said that these dumb and inanimate plates by contact can produce a

the jungle, that the further I advance, the more frequent are the visitations of cholera known to be, until at last when I arrive well out into the open, I shall learn that the dreaded 'dookee,' as the pestilence is called here, comes every year to carry off her hundreds of victims.

"Now this is a fact of which I have satisfied myself by close observation and careful inquiry during my recent circuit through the division ; I have verified it till not a shadow of doubt could remain in my mind." (Major Nembhard's 'Report to the Sanitary Commissioner for Bengal.' See Report for 1866, pp. 57, 58.)

I am told that Dr. Strong was so strong in his belief that trees led to cholera, that he used all the influence he possessed to have the trees in and around Calcutta cut down. In Calcutta they were the element to produce cholera; in Chutteesgurh, to form a protection against it.

force so potent as electricity, and shall it be denied that the touch of lovers' hands can produce a force at least equally potent? I think not, and we may be pretty sure that the thrills and raptures which afflict lovers when they are near each other, are in their causes more closely allied to the physical forces of the earth than will be readily admitted. The heat of the oxygen and hydrogen blow-pipe cannot traverse glass till it has been passed through the body of a cylinder of lime; and nervous force fails to pierce the heart of Corydon till it has passed through the tissues of the lovely Phyllis, after which it is capable of both piercing and wrecking him.

Is our environment or surroundings the same one year as another? This question must be answered negatively. It therefore becomes necessary to ask, what are the means by which it is made to differ from year to year? We have the climates of season and latitude, we have also secular climates. Some of the causes of secular climate are known to us; some, but not all.

(*a.*) We know from geological records, and from what has been seen of volcanic action in these times, that chemical action is going on within the earth to a vast extent; and we also know that the action of the atmosphere on the surface of the earth in oxidizing it, is daily introducing change into our surroundings. Exact knowledge as to the amount of influence which these causes exert in changing climate, is much wanted, but that they do exert such an influence cannot be doubted.

(*b.*) The body of the sun appears to be undergoing some chemical change, as evidenced by the changes which are always taking place in his spots. This change appears to introduce secular changes into the globe through the medium of magnetism, as I have already shown.

(*c.*) The sun moving in space, and carrying his planets with him, submits himself and them to different combinations of influence, for the stars fixed and otherwise must necessarily influence us by means of their gravity and light.

(*d.*) The earth in a long series of years completes a secondary but very complicated motion, in virtue of which its northern and southern hemispheres are alternately more exposed to the sun. Again, even in longer periods of time, the orbit of the earth alternately grows to be more and more, and then less and less circular.* These astronomical changes necessarily affect the distribution of heat on the earth's surface, and by doing so they lead to changes in the climate of latitude, which in turn narrow or widen the zones of animal and vegetable life.

*Comets.*—The visits of comets must change the economy of the earth, because these bodies add to our light and probably also to our heat; and additions cannot be made to the sum of our light and heat, without in some way changing the climates of the world.

*Rising and falling of the earth's crust from volcanic action.*—For thousands of years the surface of the globe has been rising and falling. It is thought that at one time there was a large continent in the Pacific Ocean. If this were to rise again above the surface of the water, the climate of the globe would be revolutionized. For one thing, the climate of the northern hemisphere would become more severe, and that of the southern hemisphere more variable. Volcanic agency is still at work in our times; and it has been found that the western coast of South America is steadily rising, and that the lands of Northern Europe are in some places rising and in others falling. Nor are these slow processes of elevation and depression limited to those coasts; and superficially as the phenomena have been studied, it is already known that they are going on less or more almost all over the globe.

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* See Herbert Spencer's 'Biology.'

Increasing or lessening the sea here and the land there, is necessarily followed by a change in the climate of localities. The change may be slow, as the processes which lead to it are slow, but it is nevertheless sure. Much of Scotland, Scandinavia, and some of the Baltic shores have greatly risen in the latter centuries. If these risings have, on the whole, increased the mean annual temperature of the northern hemisphere, they at the same time have increased the heat of the northern summers, and the cold of northern winters, other things being equal.

*The works of coral animals.*—Although the geographical influence of these depends indirectly on the results of volcanic action; still so considerable is now the aggregate surface of coral islands, especially in the Pacific, that in the enumeration of the chief causes of secular climate, it is necessary to give them a place.

*Plants and the lower animals.*—The following extracts from Mr. Darwin's 'Origin of Species' give us some insight into the influence which plants and animals exert over the organic life of a country, and through that over climate and man. He says, speaking of Farnham in Surrey, "Here there are extensive heaths with a few clumps of old Scotch firs on the distant hill-tops: within the last ten years large spaces have been enclosed, and self-sown firs are now springing up in multitudes so close together that all cannot live. When I ascertained that these young trees had not been sown or planted, I was so much surprised at their numbers that I went to several points of view, whence I could examine hundreds of acres of the unenclosed heath, and literally I could not see a single Scotch fir, except the old planted clumps. But on looking closely between the stems of the heath, I found a multitude of seedlings and little trees which had been perpetually browsed down by the cattle. In one square yard, at a point some hundred yards distant from one of the old clumps I counted thirty-two little trees." Cattle excluded from the heath, it gradually becomes a wood, and, as such, very materially affects the climate of the locality, as we have seen when relating the influence of trees. Again, the same author says, "I have found that the visits of bees are necessary for the fertilization of some kinds of clover; for instance, 20 heads of Dutch clover yielded 2290 seeds, but 20 other heads protected from bees produced not one. Again, 100 heads of red clover produced 2700 seeds, but the same number of protected heads produced not a single seed. Humble-bees alone visit red clover, as other bees cannot reach the nectar. It has been suggested that moths may serve to fertilize the clovers; but I doubt this in the case of the red clover, from their weight being apparently not sufficient to depress the wing petals. Hence we may infer as highly probable that if the whole genus of humble-bees become extinct or very rare in England, the heart's-ease and red clover would become very rare, or wholly disappear. The number of humble-bees in any district depends in a great degree on the number of field mice which destroy their combs and nests; and Colonel Newman, who has long attended to the habits of humble-bees, believes that 'more than two-thirds of them are thus destroyed all over England.' Now the number of mice is largely dependent, as every one knows, on the number of cats; and Colonel Newman says, 'Near villages and small towns I have found the nests of humble-bees more numerous than elsewhere, which I attribute to the number of cats that destroy the mice.' Hence it is quite credible that the presence of a feline animal in large numbers in a district might determine, through the intervention first of mice and then of bees, the frequency of certain flowers in that district!" From these instances it can be understood what an important part the lower animals and vegetables play in influencing the climate of a locality.

*Man.*—The power of man to change climate is comparatively speaking limitless, but the fact that it is so has scarcely yet dawned on us. In South Australia he has cut down so many trees that he has rendered the climate of this country drier. He has brought about much the same result in the south of France. In both of these localities he is busy planting again, and in time he will largely undo what he has done. By draining them he has made great tracts of country, which in temperate climates were cold and moist, warm and dry. By irrigation and the conservancy of rain he has, as in India and Egypt, turned deserts into gardens and fruitful fields. Doubtless in the future history of climate, irrigation will play a leading part; and we must admit this, when we reflect what a change the waters of the Nile, which now flow into the Mediterranean, would work in the Egyptian desert, if they could be judiciously showered over it. He has, by the mixing of certain substances with soils, enabled fields to grow crops which previously they were incapable of growing. By the transport of animals and vegetables from one country to another, he supplies food and instruments for populations which in time, by their industrious pursuits, change the surface of countries. But, more than all, by the exchange of knowledge in free intercommunication with his fellows, he is rapidly getting such command over the forces of the world, animate and inanimate, as is enabling him to shuffle the elements more and more easily, and which in time will enable him to shuffle them with much the same facility as he now shuffles a pack of cards. Already at his bidding they warm and cool him. They dig and sow and reap for him, they cook for him, and with their subtle essences they make him merry, they carry him at the rate of seventy miles an hour, and in carrying his messages they put a hoop round the world in much less time than Ariel; they spin clothes for his back; they paint and make music for him, they solve arithmetical questions for him, and it may safely be predicted that in time they will also solve his mathematical problems, and assist him in working out those processes of thought which he now distinguishes by the name of high reasoning. This completes my analysis of our surroundings. It is rough and in skeleton, but it is enough to make us, on the one hand, careful against attributing any phenomenon to any single cause, and on the other, hopeful that much of what is now mysterious and unintelligible in men's behaviour, will become plain and clear in the growing light of science.

## XV.

When we consider of how many elements our surroundings are made up, how intricately these are mixed, and how, like the chameleon and the kaleidoscope, they are for ever taking new shapes and colours, and, as a consequence of these changes, acquiring new properties, we begin to ask ourselves if we may not be wrong, and in too great a hurry in tracing this disease to that simple cause, and that other disease to this simple cause. I may be in error, but I cannot help believing that our diseases are the result of the combination of all the influences to which we are being subjected when they manifest themselves in our tissues; and that the greater or lesser tendency which our tissues show to take on diseased conditions, is the result of all the combinations of external influences to which we in our own persons, and in the persons of our ancestors, have been subjected previously to the time when we became diseased. Believing this, I am forced to compare the man who traces cholera to the drinking of a particular water, and intermittent fever to the rotting of certain animal and vegetable matter, to the Australian savage whose imagination leads him to people trees and stones with good and evil spirits, to whose agency he attributes all the ill and all the good which overtake him in life.

The mischievous doctrine of poisons seems to narrow the minds of men, and to dam up their currents. Does a man get an ague, he is poisoned; does he get cholera, he is poisoned; is he seized with smallpox, he is poisoned. We say so without any grounds for the assertion, and, what is worse, we invent a high-sounding name to express what we do not know, and to hide our ignorance. There is no greater obstacle to the progress of our science, than this custom, which too many have adopted, of believing in words instead of things. Now, it is not improbable that in all instances some one thing (different in each instance) is the last straw which breaks the camel's back, nor is it to be denied that many diseases can multiply themselves in our tissues, if circumstances are favourable, but that the great majority of cases of cholera or smallpox, or intermittent fever, are either caused by poison or by contagion will never be admitted by the man who has studied these in their epidemic form, and who knows their histories. We have hitherto been too prone to regard diseases as so many entities, instead of so many conditions of our tissues, and in this way we have come to believe in a vague sort of way that many diseases propagate themselves, after the manner of plants and animals, in place of looking on them as being developed anew under the stress of external circumstances.

Typhus fever appears among a people when they are afflicted with famine and despair, and typhus fever can be communicated. If, then, typhus fever can be developed in our tissues by certain combinations of external influences, and if it can afterwards multiply itself by contagion, why should not cholera and smallpox be similarly developed and similarly multiplied? To attribute cholera to a lurking poison, and then to account for its spread by contagion, is a doctrine so easy to be grasped and understood, that the human understanding, naturally lazy, and slow to rouse itself, readily listens to it, and with but little question adopts it. But granting that in the instance of cholera, the disease can be communicated,—which they who have thought most about it doubt,—a knowledge of the conditions necessary for its development in an epidemic form, is still the chief element in the study of the affection. When we have acquired this, we shall understand why, when it has once invaded a country, it ever leaves it; why it travels westward from Asia and Europe, to America, and not eastwards; how it advances against the winds; why it sometimes marches along one side of the street and avoids the other side; why it sometimes slays one village and spares its immediate neighbour; why it once appeared murderously at Hurdwar Fair, where sanitary arrangements had been made with surpassing care as a protection against it, having absented itself from previous fairs at the same place, when no sanitary arrangements had been made at all; why isolated cases of the disease may occur all the year round in a country which is sometimes afflicted by it in an epidemic form; why, sweeping onwards like a stately shadow, it began its slaughter in Chicago at a time when men were dreaming that by their medical police they were keeping it at bay at New York and Boston; and how two years ago, when we were expecting it at Southampton, it appeared at Epping Forest, swift and deadly as a stroke of lightning.*

Some men say that cholera only recently appeared on the earth; others deny this, and affirm that were its history carefully traced, it would be discovered that cholera had afflicted men for many centuries. To the former I say, if the disease only recently appeared among men, then, when it did appear it was generated *de novo*, and having been generated *de novo* over Bengal, its reputed birth-place, why should it not be generated *de novo* at any other place at any other time? And I ask the latter, if cholera has always been the companion and enemy of men, how is it that it did not invade Europe before the nineteenth century? It could scarcely be, that there was in other times no stream of human intercourse along which it might travel; for the illustrious Tamerlane, after having taken Delhi and scoured even Hurdwar itself, met and overthrew Bajazet before the walls of Angora, and then chased the remnants of his scattered army into Europe. It may be objected, "How was it that smallpox did not appear in America till after the date of the Spanish invasion?" I answer that smallpox did not appear in the East before the fifth or sixth century of the Christian era, and not in Europe till many years later: and if it had not invaded America before the Spaniards, it is probable it would have done so even if America had remained undiscovered. To those who doubt this, I commend the following extract from the works of John Hunter:—"Extraordinary effects are produced by the Harmattan wind, a wind which blows off the interior part of Africa to the coast of Guinea. . . . Though very prejudicial to vegetable life, it is salutary to animals, curing fluxes and other epidemic disorders, and often restoring weakened constitutions. Fevers which had been imprudently reduced by bleeding, got well in spite of the doctor. The smallpox always yields to it, while it prevented the inoculation from taking effect in some African slaves. Such as were inoculated before the Harmattan set in, had the smallpox, and all did well; but such as were not then seized with the symptoms—and these were sixty in number—never felt any other affection but a slight fever and nausea during the continuance of the wind; after which it showed itself in twenty of them; the others were re-inoculated, and all did well."

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* I make this statement with a knowledge of the details of the Groombridge cases.

## XVI.

In this paper, where it has been necessary to refer to what is called mental processes, I have done my best to avoid the doctrines of psychology, and to trust entirely to those of cerebral physiology. Physiologists teach that the mind can operate independently of the brain tissues, physiologists maintain that it cannot. This is the difference between them, and it is a very wide one. The former, although they do not exactly deny that the mental phenomena depend for their quality and extent on the quality and extent of the brain tissues, still refuse to affirm it; the latter not only affirm it, but regard this truth as the foundation of their science, and of all true mental science.* Starting so differently, psychologists and cerebral physiologists necessarily take very different views of education. As cerebral physiology is in its infancy, and psychology in its old age, it follows that the system of education at present in vogue has a psychological basis; and it seems to be the opinion of most of our statesmen, and many of our leading authors, that education, that is, the teaching of two dead languages, a portion of mathematics, geography, perhaps drawing, and a smattering of physical science, is the magic wand before whose waving all our evils, social and political, are to disappear.

Physiologists cannot agree with those men. Education as at present given at schools and colleges, inasmuch as it teaches us to read and write, and supplies us with the elements of the simpler sciences, which are now being applied for the comforts and convenience of man, provides us with a portion of those means by which we earn our daily bread, but this is about the only good which we derive from it. To say that it teaches us to be brave and generous, truthful and self-sacrificing, when we naturally tend to be the contrary, is to assert what the results of every school and college in the land disprove daily. Let us look for a moment into the history of our country, and we shall see that many of the men whose achievements have ennobled us, got their so-called education as the wild birds get their food, and that many of those other men of whose achievements we are now heartily ashamed, and it may be whose busts now decorate Westminster Abbey, were school and college bred. Men are great or little, good or bad, not by the influence of their schools and colleges, but in spite of them. Then is education of no avail at all, and are we to give it up? No, but let us give it its proper place and just weight in the general estimate. It is the oil to the wheels, and the varnish to the surface, but not the substance. It seems to me that we shall make little progress in the improvement of our race, till we give our moral and mental philosophy a physiological foundation, instead of the metaphysical and sandy one on which it now rests; till we judge and treat our brains as we now judge and treat our livers. There was a time when insanity was looked on as the work of a devil, and holy men were called in to exorcise him. Now, what should we think of a nation which believed and acted on such a doctrine in those days? We should pity it, and pronounce it plunged in barbarism and superstition. But here we are asked what has vice to do with lunacy? What have they in common? My answer is they are the same; they differ in degree, but they are the same in kind,* and the sooner we admit and act on this, the better for ourselves. The phenomena of vice are as much the consequence of conditions of our tissues as are the phenomena of lunacy. Very many men will exclaim against this doctrine as demoralizing and utterly atrocious; and society, they will tell us, could not hold together for long if such a doctrine were to prevail. But these are men who do not think, or who have no faith in their kind. If all the laws were abolished to-morrow, society would hold together, and perhaps frame more suitable laws than we have now; but the admission that vice is a condition of tissue, or rather the physiological expression of conditions of tissue, does not commit us to the abolition of punishment. If flogging will do the vicious man or society good, by all means flog the vicious man; or imprison him, if the public good require it; nay, hang him outright, if society cannot be secured in any other way. Only let us know what are the principles on which we punish. But in whatever way statesmen and philosophers may settle our laws, when vice is viewed physiologically, we may rest assured of this, that by the force of external influences other than those of education, we can make a virtuous man into a vicious man, just as we can make a sane man a lunatic, and *vice versâ*. Let us once admit that vice is the expression of conditions of our tissues, as we must sooner or later do, and we shall begin to deal with it in a very different way from what we have hitherto done. Ceasing to be a metaphysical shadow, it will become to us a substance which we can measure, touch, and change, by

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* Mr. Mill jeers and scorns M. Comte for preferring cerebral physiology to psychology; nay, he makes merry over what he considers to be the fundamental error of the dead philosopher. The passage (in his examination of Comte's philosophy) where he has so committed himself will, more than any other passage which he has written, show that he never, notwithstanding his wide reputation, had a clear conception of the relation of things.

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* Let any one read Dr. Hood's evidence before the Capital Punish-

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ment Commission, and he will be struck with the clearness of his answers when he is questioned on insanity, as compared with the haziness and vagueness of his language when he is questioned on the difference between vice and lunacy. Lord Stanley's questions are so coldly clear and so logically connected, that Dr. Hood could not in turn be equally clear and logical without recognizing vice and insanity as the same in kind.

submitting a condition on which it depends to the influence of the reagents which compose our surroundings; and having become so, we shall set about manipulating and modifying the conditions as we now modify and manipulate our horses, our dogs, and our sheep. In despair of being able to root out vice by moral teaching and repressive laws, we shall then try to eradicate it by *breeding* healthy brains; and when we have bred these, by surrounding them with influences favourable to the growth and development of brain tissues. If this paper indicates anything, it indicates this, that our minds, through the medium of our brains, are as much within the influence of things external to us as are our bodies. If, therefore, we would make ourselves the masters, and not the slaves of such slight things as winds and smells and colours, we must labour unceasingly until we know the exact relations which our tissues and surroundings bear to each other, and how the latter may be applied to our benefit and not to our hurt.

ROBERT BIRD, M.D.

*Note.*—I am under obligations to the following works:—Miller's 'Chemical Physics;' Chevers' 'Preventible Diseases;' Todd and Bowman's 'Physiology;' Draper's 'Physiology;' Davy's 'Chemistry;' Tyndall 'On Heat;' Tyndall 'On Sound;' Balfour 'On Heat;' Herbert Spencer's 'Biology;' John Hunter's Works; Comte's 'Philosophy;' Buckle's 'History;' Draper's 'Intellectual Development of Europe;' Graves' 'Physiological Studies;' Mill's 'Political Economy;' Sommerville's 'Physical Geography;' Keith Johnston's 'Physical Atlas;' 'Cyclopædia of Anatomy and Physiology;' Professor Bain's Works; 'The Heavens,' by M. Guillemin; 'Fallacies of the Faculty,' and others, to which I have acknowledged myself obliged in the body of the paper.

# ON THE ORIGIN OF DISEASE.

(*Published in the 'Indian Medical Gazette,' June,* 1870.)

## I.

In most cases of ordinary intermittent, or of ordinary remittent fever in Howrah, the carbonate or aromatic spirits of ammonia will be found equal to reducing the heat of the body to the healthy standard. When these fail to do this, I combine them with sulphuric ether, and this combination rarely fails to bring about the result which is desired; but should it so fail, then if sulphurous acid drink be given in addition to the mixture of ammonia and sulphuric ether, failure will be the less often met with. When the administration of all of these remedies has disappointed our hopes, then the addition of a few minims of diluted prussic acid does not unfrequently enable the medicine to succeed when before it had failed. How is it that in one case a simple remedy is able to cure, and in another case a cure cannot be obtained, unless through the operation of several remedies mixed? In answering this question, I will, in the first instance, to simplify the matter, suppose the bodies of all the patients under examination to be the same in every particular; *i.e.*, the different tissues composing each are the same in all their modifications—the same in constitution as in action.

## II.

Fever, which I regard as the condition of our body on which all other diseased conditions are based, and without which no other diseased condition can make head, is recognized by the presence of heat, greater than the natural heat in, at least, some portion of some tissue; but it really confines its manifestations to one tissue or to a modification of a tissue. On the skin it may show itself in circumscribed spots, or on one-half of the trunk, or on one limb (as in elephantiasis); but, as a rule, in addition to these local invasions it is discernible elsewhere,—there is a sense of heat in the mouth, or throat, or intestinal canal; or perhaps there is a hot headache, or a burning pain in the bladder and kidneys. Commonly, a large extent of the skin is hot, and a large portion of the mucous membrane of the gastro-intestinal canal also; while not unfrequently the folded tissues of the glands are the seat of increased temperature. At the same time I have met with many instances where the field of increased temperature on the skin could be covered with a tea-cup, and where abnormal heat could not be detected elsewhere. We may, however, conclude that fever, when it burns, burns in more tissues than one,—in tissues whose differentiation is different.

## III.

Leaving the question of how diseased action should prevail at the same time in tissues of different differentiation to be answered in the latter part of the paper,* I will here state that it appears to be a law that the same remedy, having different relations to different tissues, acts on each differently; and that consequently a certain remedy, when it checks fever in one tissue, fails to check it in another. Thus ammonia may reduce the temperature of the skin in fever, while it fails to reduce the temperature of the mucous membrane of the stomach and bowels in fever. On the other hand, sulphurous acid cools the stomach and bowels, and has less power over the skin. These observations lead us to note the relations which our different tissues bear to the different agencies outside of us—agencies to whose operation on us we owe all the phenomena of life, and without which we should die. Each tissue, or modification of a tissue, is more moved by this agency than by that; nay, by this it is powerfully moved, and by that it is scarcely moved at all. Thus light moves our optic nerves, and not our auditory; while sound moves our auditory nerves, and not our optic.* This principle will become more real to us if we picture to ourselves the effect of placing the secretion of our bladders in our stomachs. Urine gives little trouble to our bladder, an organ composed of muscle, mucous membrane, and connective tissue, but does it do so to our stomachs, another organ composed of muscle, connective tissue, and mucous membrane? and thus it follows that when disease has invaded more tissues than one, a remedy, to do a general good, must be mixed.

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* I have not been able to do this on account of want of space.

## IV.

In a note on sulphurous acid, published some time ago in this Gazette, I said I believed that substances which are powerful to absorb radiant heat in shut chambers, are also powerful to absorb radiant heat among the tissues of the body; and at the same time I pointed out that three powerful absorbers of radiant heat, viz. sulphurous acid, sulphuric ether, and ammonia, are also powerful febrifuges. After a longer experience, I am confirmed in this belief. Melloni was, I think, the first to show that the same heat, that is, heat derived from the same source, undergoes a

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*** This difference is comparative, not absolute, for the vibrations of sound can be transmitted through our optic tracts, and the undulations of light have an effect on our auditory nerves.**

different modification in being passed through different substances. Thus he passed heat through a Locatelli lamp, incandescent platinum, and a ball of copper blackened, and he found that of one hundred rays from the lamps, seventy-four passed through a screen of Sicilian spar; of a hundred rays from the platinum, and of another hundred from the copper, seventy-seven and sixty rays passed through the same screen respectively. And in like manner he found that screens made from many other substances had each the power of arresting a different number of the hundred rays proceeding from each of these sources of heat.* Again, if we introduce a cylinder of lime into the oxy-hydrogen light, the heat from this light acquires the property of traversing glass, which it scarcely had in any degree before. From these simple experiments it appears that heat is modified in its transmission through substances, and that each substance modifies it differently, and gives to it, or withdraws from it, some property or properties.

In this we see another reason for giving mixed remedies in fever. The heat radiated by the skin is different from the heat radiated by the mucous lining of the intestinal canal, and is controlled by ammonia; while the heat radiated by the mucous tissue of the intestinal canal, being different from that radiated by the skin, is controlled by sulphurous acid. Granted that ammonia and sulphurous acid check fever in this way, then it appears that they act in the same way as cold, when applied to the tissues, as, for instance, when a man is frozen in snow. In both instances motion is reduced or stopped by absorption of the heat radiating from the tissues.

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* 'Nouvelles Recherches sur la Transmission immédiate de la Chaleur rayonnante par différens Çorps solides et liquides; présentées à l'Académie des Sciences, le 21 avril 1834, pp. 6–12.' See also papers by Brewster on the communication of different properties to light, and Roscoe's 'Treatise on Spectrum Analysis,' where abundant instances are given of the power of different substances over light.

## V.

Heat is, therefore, to be regarded as the source of all motion; and variety of motion results from the action of heat on, or from the transmission of heat through, different substances. In this way light, electricity, and magnetism are to be regarded as modifications or transmutations of heat for each and all of these forces; or, in other words, modes of motion can be obtained from heat by transmitting it through certain substances, arranged in a certain way. Indeed, every modification of each force, and every force may be regarded as heat thrown into a different mode of motion; or, in other words, each force or modification of force is a peculiar motion of matter which, when recognized, is named after the force, or modification of force, of which it is the expression. This much apprehended, we begin to see how the aggregate of motion or heat is different in one locality from what it is in another locality. Heat (and light, which is merely a modification of heat) from the sun as soon as it impinges on the globe, excites a motion in each substance which it permeates; at the same time it is changed from what it mingles with. As we have seen from Melloni's experiments, it is not the same mode of motion when it emerges from a body, as it is when it enters it, and on leaving a body it has acquired different properties from those which it had when it met it. The sun's heat, therefore, when in all its rays it is reunited in the atmosphere after after having been transmitted through the surface of the earth, and the bodies on the surface of the earth, is, in the aggregate, different from what it was when it fell upon the surface of the earth and the bodies on that surface. And thus we see how the aggregate of heat in one local atmosphere is different from the aggregate of heat in another local atmosphere, because the matters or heat modifiers of one locality are different from the matters or heat modifiers of another locality; the rocks, the trees and grasses, the waters of this locality are not the same as they are in that other locality. We are all familiar with the differences in the heats of different days, differences which are not measured by the thermometer. These differences are differences in the quality of heat, for we have heats of different quality as surely as we have heats differing in intensity; but as yet we are not possessed of an instrument by means of which we can indicate easily changes in the quality of heat.

## VI.

Above I have stated that heat is the source of all motion, and without heat motion would not be possible. This statement is illustrated in the human tissues when a man is frozen in snowdrift. Frozen, the motions of his body stop; thawed, these motions reappear. Heat is also that on whose operation the growth and development of ova depend, as is familiarly shown in egg-hatching. Growth and development result in a mass of tissues, folded after a certain shape, which has certain tendencies and capacities, and which is to be regarded as stores of motion of different modification. The friction of external agencies upon these tissues give rise to many phenomena. Amongst those are feeding, digestion, assimilation, muscular action, and brain actions, which in their muscular expression we call reading, writing, and so on. In this never-ending friction the removal of these tissues does not exactly correspond to the waste, and hence a difference. This difference taking place in tissues from the friction of external agencies upon them, we name differentiation; and differentiation goes through many phases in the life of a being, furnishing many shapes and stages, which are expressed in the career of an individual from the time of impregnation to the day of death. Uterine life, infancy, youth, old age, and death itself, are merely forms and results of differentiation. But there is also another form of differentiation which is common to tissues, and this is disease. Above I said that growth and development, as directed by heat, lead to the storing up of modified force in the shape of tissues. Now, while these tissues, when moved by external agencies, display the phenomena of healthy life, they not unfrequently also, when acted on by the same, display the phenomena of disease. Disease may be considered either a consumption of tissues, without renewal, as in the wasting of fever, or as the transformation of a tissue from a higher quality to a lower quality, as when the lining membrane of arteries change and lead to aneurism, or as when muscles undergo the change known as fatty degeneration. Growth not unfrequently takes place in these lower tissues, as in tumours.

## VII.

Differentiation, then, is merely the expression of the action of external agencies on a body of certain tendencies and capacities. If this body is an impregnated ovum, the friction of external agencies on it drives it to develope into a being composed of many tissues, each of which is different from the other, and every portion of each of which is different from every other portion; tissues, moreover, which are connected with each other by means of inferior tissues, which go on differing from the superior tissues by insensible degrees. The superior tissues are the nerves, the muscles, the bones, and the secreting tissues; the inferior are spoken of generally as connective tissue.

## VIII.

Here, then, on the one hand we have a web of living tissue most minutely differentiated, and folded into a shape which we designate human: this is the instrument. On the other hand, we have an atmosphere full of minutely differentiated heat capable of moving this web: this is the player; and the music or discord express the transmutation of heat into motion of the tissues.

## IX.

This seems to be the place to give some instances illustrative of the action of heat on the human tissues.

(1.) If we take a man and freeze him in snowdrift, all motion in his tissues will come to a stand. In his frozen state he is not conscious; he cannot use his muscles, and secretion in his various glands stops. If we apply heat to the frozen tissues, motion reappears in them; and the man again grows conscious, uses his muscles, and his glands resume their arrested functions. In this instance the withdrawal of heat stopped motion, and the application of heat restored it.

(2.) If we place the impregnated eggs of fowls or ducks in a hatcher, and apply heat by means of burning gas or oil or kerosene, chicks or ducklings will in time emerge from the shells. This is a very clear and plain instance of heat leading to growth and development; so clear and plain and so familiar, that we are apt to pass it by without reasoning on it; to pass it by as a thing of course.

(3.) —, professor of moral philosophy, could not enter a room, the floor of which was covered by a carpet having a certain combination of colours, without suffering from unconquerable nausea.* Here the modified sunlight, the sunlight modified by the colours of the carpet, and acting through the optic tracts, moved certain nerves and muscles in the way which leads to nausea.

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* This, and some other instances given here, belonged to the collection given in my paper on Idiosyncrasy.

(4.) During a visit to Berlin, Peter the Great one day after dinner stepped out on a balcony which looked into the gardens. Seeing many people assembled below, he gnashed his teeth, and began giving signs of frenzy. Shifty little Catherine, who was with him, requested that a certain person down among the crowd, who had a yellow wig, should be at once put away. This done, the Cæsar became quiet again. In this case, the sunlight modified by, and reflected from the yellow wig, and acting through the optic tracts, moved those portions of the brain and those muscles which express anger and frenzy. What is to be noted and pondered over in these instances is this, that sunlight, modified in certain ways, moved the tissues in certain ways.

(5.) Mr. Dobson, Deputy Superintendent of the Alipore jail, some years ago suffered much from coryza. For this he took many remedies, and tried change of air without effect. He was recommended to wear coloured spectacles; he did so, and the coryza at once disappeared. Here the sunlight heat acting through the tissues of the eye, induced the irritation or inflammation of the mucous membrane of the nose, known as coryza.

(6.) Last year I had a patient who suffered from an affection closely resembling rheumatic ophthalmia. The attacks always yielded when he wore blue spectacles. In this case the diseased motion in the eye appeared to be produced by the blue and chemical rays of the solar beam, and not by the red, yellow, and heat rays.

(7.) The sunlight and heat, when modified by a sandy plain, and reflected from this on the tissues of the eye, often produces ophthalmia.

(8.) The direct rays of the sun in India produce in a body, sufficiently exposed to them, that condition of the tissues known as sun-fever. This often assumes an intermittent or remittent form, and is scarcely to be distinguished from malarious fever, as it is called; yet the condition is produced by sunlight and heat.

(9.) The direct rays of the sun set a-going that diseased motion of the body known as sunstroke, the leading symptoms of which are unconsciousness and a burning heat of skin. It is remarkable that the surest way to check this burning up of the tissues, is the application of cold externally, and the administration of that powerful heat absorber —ammonia—internally.

(10.) A hot iron or hot water applied to the skin will inflame it; and, in some instances, the diseased motion set going in this skin in this way proceeds inward, and eats or burns a hole in the duodenum.

## X.

With these instances to guide me, I will now ask the question, "If heat in its different modifications can cause coryza, ophthalmia, nausea, inflammation, and fever, why should it not, having undergone certain modifications, cause cholera, smallpox, and fevers of every kind?" In smallpox there is a production of pus, so there is in ophthalmia, and if the pus of smallpox can be multiplied in healthy tissues by contagion, so can the pus of ophthalmia. If certain secretions are increased in cholera, so certain secretions are increased in coryza. If nausea is present in cholera, so it was in the case of the moral philosopher. These conditions, which we know are produced directly by the application of heat, are as complex and extensive as are those other conditions brought about by the causes of cholera, smallpox, and malarious fever so called; and if it has been proved that heat is the cause of the one, then it is very probable that in time it will be proved that heat also is the cause of the other.

## XI.

Smallpox, typhus fever, and perhaps cholera and yellow fever, can multiply themselves by contact in the tissues of other individuals predisposed to their influence, and this property of these diseases has assisted in throwing around them a mystery which has delayed men in getting to have a clear conception of their nature. Alison, one of the most acute observers, states that remittent may become intermittent; and intermittent, typhus fevers; and, consequently, that a non-contagious fever may become a contagious fever. It does so apparently from its intensity. From Melloni's experiments we know that when a heat radiating from some source has failed to traverse a screen, it succeeds in traversing it after its intensity has become increased. In this way I believe the heat radiating from the bodies of men suffering from typhus fever sets going that condition of the tissues—that diseased motion—known as typhus fever, in the bodies of other men near at hand, on which it impinges,—when the heat radiating from the bodies of men suffering from intermittent fever has failed to engender intermittent fever in the bodies of other men in the neighbourhood, on whom it impinges.* So with cholera in the North-West of India. Medical men in the North-West of India assert that cholera is contagious or communicable; medical men in Bengal assert that it is not; I believe both are right, but in the North-West the diseased motion is more intense, and we know that an intense motion proceeds further than a motion which is not intense.

## XII.

A man liable to disease suffers in this, that, and in the other tissue, according to the kind of heat acting on him. In

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* In making this statement I do not, of course, deny that disease may be communicated through the medium of garments, etc.

Lower Bengal he will probably suffer from dysentery, in Scinde from boils, at Mussoorie from diarrhœa, in England from typhus fever, and so on; and in England he will suffer from different diseases, according to the seasons. In winter he might have pneumonia, and in summer or autumn, diarrhœa. He does so because in these different localities and seasons the local atmospheres, or aggregates of force in each instance, differ from each other; the aggregate of heat in Scinde is not the same as that of Bengal, and in England it is not the same in winter as in summer. Since everything modifies heat, we understand why in England the heat of winter is different from that of summer, independently of the movement of the earth round the sun, when we reflect that in summer the fields are covered with crops, and the trees with leaves; and in winter the fields mostly, and the trees are bare.

## XIII.

All men are not seized with the same disease at the same time. This is because all men are different.*

When the external influences acting on bodies are different in the aggregate, then the differentiation in these bodies, resulting from the action of those influences, is in each instance different. In this way it is that no two men in their anatomy, and consequently also in their physiology, are alike.† But for this, all the people of a neighbourhood would be all well at the same time, all sick at the same time, and would all die at the same time. In another section I pointed out that one tissue is moved by this heat and not by that, while this tissue is moved by that heat and not by this, according to its differentiations. So, in disease, this man's lungs are moved to inflammation by a certain modification of heat, while the lungs of another man are not moved to inflammation by the same heat, because they are insensible to its action in virtue of some difference in differentiation. We explain the protection afforded to individuals by vaccination in the same way.

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* For a statement of some of the anatomical differences of men, I must refer to my paper on the subject, published in the 'Indian Annals of Medicine,' 1865.

† In my paper on Idiosyncrasy, to which this may be called a sequence, published in the 'Indian Annals of Medicine,' 1868, I have given many instances and proofs of physiological differences.

## XIV.

The movement of the earth round the sun explains why we have different seasons, and different diseases in each season. It does not, however, explain why the diseases of one season should differ from the diseases of another season, or why old diseases should die out, and new diseases appear. To explain these phenomena we must refer to cosmical changes. These are neither few nor unknown, but being to us so remote, and, as it were, so shadowy, they have hitherto scarcely been taken into account in our attempts to explain the origin of disease.

But we have now scientific ground on which to rest the theory that cosmical changes influence our tissues. We now know that chemical changes in the sun directly produce changes in the magnetism of the earth, and we also know from spectrum analysis that the light from the fixed stars is not the same as sunlight. Again, we know that modifications of force (as in Dobson's case) influence our tissues in a way according with the kind of modification; and knowing this much, we conclude that a change of the position of the planetary system in space must affect us, for by this the influence of systems outside of our planetary system is ever changing, and we also know that changes in the forces of the sun and planets cannot take place without our tissues being affected by them. The following may also be named as causes leading to changes in disease :—

(*a.*) Chemical changes in the body of the earth, sun, and stars.

(*b.*) Changes in the angle at which the heat of the sun hits the earth.

(*c.*) Changes in the form of the earth's orbit.

(*d.*) Comets.

(*e.*) Rising and falling of the earth's crust from volcanic action.

(*f.*) The works of coral animals.

(*g.*) And the action of plants, lower animals, and man on the surface of the globe.

All of these causes lead to changes in the local climate in which individuals live, and consequently to changes in the tissues of individuals, acting through a series of generations by inheritance.

## XV.

To help our imaginations in grasping the idea of the vast power which heat and light have over organized tissue, I adduce this extract from the writings of Humphry Davy: "Whoever will peruse any considerable part of the vegetable statics of Hales, must receive a deep impression of the dependence of the motion of the sap upon physical causes. In the same tree, this sagacious person observed that in a cold, cloudy morning, when no sap ascended, a sudden change was produced by a gleam of sunshine of half an hour, and a vigorous motion of the fluid. The alteration of the wind from north to south immediately checked the effect. On the coming on of a cold afternoon after a hot day, the sap that had been rising began to fall. A warm shower and a sleet-storm produced opposite effects."

('Agricultural Chemistry,' p. 233.) This shows that the vital motions of vegetables are much under the influence of light and heat; and human tissues are still more sensitive to these influences.

## XVI.

The amount of moisture in the atmosphere is in itself less a cause of disease than a medium through which heat can induce disease. In dry air a higher temperature can be borne than in moist air. Thus the human body can endure a much higher temperature in a chamber of dry air than in a chamber of moist air, in a hot-air bath than in a vapour bath. The explanation of the fact appears to be this. Dry air is able to absorb much less of radiant heat than moist air is, and consequently a moist atmosphere brings into close contact with our tissues a much larger amount (in a concentrated form) of the forces which move them to health or disease, than dry air can. In this way, I believe, it is that cholera is unable to manifest itself in a desert, that it is always liable to be sporadic in moist Bengal, that it appears after a fall of rain in the dry north-west, and that it has a tendency to become epidemic at Calcutta in March and April, when the soft southern winds arrive laden with moisture; as also how intermittent fever has a tendency to become remittent in the beginning of the cold weather. This latter phenomenon, however, requires further remark. At the close of the rainy season the atmosphere is laden with moisture charged with heat of different modifications. As the sun goes south heat is withdrawn, and the cold northerly breezes visit us, condensing, as they come, the atmospheric moisture into clouds and dew. Now the result of this process is, heat is yielded up freely, and this, striking on our tissues with vigour, converts that motion of our tissues, which we term intermittent fever, into that motion which we term remittent fever. It kindles a fire in us as steam does.

Moisture is also the vehicle in which the influence of one locality is carried to another locality. In this way it is that a change of wind is a matter of much solicitude and anxiety to invalids.

## XVII.

All volatile substances appear to affect the tissues in the same way as watery vapour, that is, by absorbing heat in various degrees, and bringing it into intimate contact with our bodies.* Smells from dunghills, from rank vegetation, and from flowers, seem all to act on us in this way.

## XVIII.

It is remarkable that epidemics have a tendency to, or do move from east to west; cholera originally travelled west, so did smallpox, and so did the cattle-plague. This law of epidemics, I think, must depend on the rotation of the earth in the face of the sun and planets. If we whirl metals between the poles of a powerful magnet, they will melt. This melting is, as it were, the result of breaking the strings of attraction between the metals and the poles. These are for ever being snapped, and for ever being renewed; and a kind of invisible friction results, which leads to the melting of a metal. There are also invisible strings binding the earth to the sun, and all the planets. Strings named force of gravitation; and these are for ever being snapped and for ever being renewed. Can this snapping and renewing be without effect on the globe, and all that moves on it? It cannot yet be proved, but assuredly the result of this invisible friction of the sun on the earth, and of the earth on the sun, by means of their respective motions, is in some way related to the direction which epidemics take when they begin to travel.

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* Tyndall's 'Experiments on Radiant Heat' illustrate this.

## XIX.

Having spoken of the tissues on the one hand, and of the aggregate of modified heat which moves these on the other, I am now to speak a few words on the action of remedies. It appears, then, that every substance, while moved by heat, in turn changes heat. The sun's heat, changed by everything it permeates, passes on into the tissues, and there becomes transmuted into motion or organized tissue, which is bottled heat of peculiar modification. This latter again becomes heat when it moves and does work. This released heat takes its character from the tissue which has released it. Heat from brain tissue is not the same as that given out by muscular tissue. But as different heats yield to the influence of different things, it follows that a different substance is necessary to control the heat issuing from brain, from what is necessary to control heat issuing from muscle. From this we begin to see that different medicines have certain powers over certain tissues, *because* of their power over heat or force.' Quinine can render the chemical rays of the spectrum luminous, and *because* it can do this, it is able also to prevent the return of fever, while sulphurous acid subdues fever, *because* it is a powerful absorber of radiant heat. The action of poisons on our tissues—strychnine, prussic acid, snake-poison, etc.—will ultimately be explained by a reference to the power which they exert over heat.

## XX.

The theory of the origin of disease above expressed may be named the heat or force theory in contradistinction to that which is known as the poison theory. It rests on the broad and sure basis of physical science in all its departments, and by means of it we are connected and interwoven, not only with the earth and everything that moves on it, but with the sun, the moon, and all the radiant stars.*

NOTE.—It will be observed that I have not referred in this paper to the negative effects of heat; such effects, for instance, as sometimes follow on the application of cold water to the feet. I have not done so, because the principle on which these are based is a secondary

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